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More Multiple-Crew Runs Needed

THE report of the Joint Committee on Utilization of Locomotives, presented at Wednesday's session, carries convincing evidence of the need for still further extension of the multiple-crew principle. With a total of only 7.40 hours per day per locomotive, including 6.10 hours on trains and 1.30 hours in road switching, the committee rightly stresses the fact that "As the total single-crew runs approach a duration of eight hours a day, the extension of hours and miles per active locomotive day should be further accomplished by multiple-crew runs and quicker return trips on short runs."

Since the length of single-crew runs is limited by the mileage and hour basis for crew compensation, the report in another point states that "To increase the average performance, this can best be accomplished by multiple-crew runs to a greater extent than the present estimated five per cent of the total." When, on account of operating or other conditions, through runs are not practicable, an increase in the number of locomotive trips per day will assist in bringing about further improvement. The conditioning of power at main terminals with only minor attention at intermediate terminals where the layover time is short will make quick return trips on the short runs feasible.

There are many factors in the problem of lengthening locomotive runs and securing the resultant advantages in the way of increased locomotive utilization. The kind and type of power available, physical conditions as regards roadbed, bridges, ruling grades, density of traffic, etc., often make it practically or economically inadvisable to operate locomotives over as many divisions as could be desired. Some of these factors may not limit the extension of locomotive runs as much as would at first appear, however, and there can be no question that, taking the railroads as a whole, much more than the present estimated five per cent of multiple-crew runs can be installed with many attendant operating advantages and economies.

Other Than Steam

FOR the first time in many years there is no straight electric locomotive on exhibition at the convention. On the other hand, there are seventeen internal combustion engines, shown separately, in rail motor cars or in locomotives. The absence of electric locomotives is probably a chance circumstance, as there is more electrification activity in this country now than at any previous time. The situation, however, indicates a condition and a trend. Electric locomotives are of pertinent interest to only a few. To the great majority they satisfy a more or less abstract interest. The rail motor cars and locomotives using internal combustion engines are affecting the operation of a majority of the railroads and interest in their development is general.

R. S. M. A. Becoming Bigger and Better

THE meeting of the Railway Supply Manufacturers' Association last Saturday morning will go down in history of that association as an event of real importance. The story of the growth from the informal get-together of a small number of supply manufacturers, which exhibited in the halls and corridors of the hotels in Saratoga, N. Y.; Old Point Comfort, Va., and in other places where the former Master Car Builders' and American Railway Master Mechanics' conventions used to meet, to 400 exhibitors occupying 145,600 square feet of floor space as it did in 1926, is replete with interesting and amusing incidents. It is a tale of real accomplishment in the face of difficulties frequently considered well-nigh insurmountable.

The present organization of the R. S. M. A. goes back to the years 1900 and 1901, when the exhibits and conventions of the mechanical associations were held in Saratoga. By that time, the exhibits of railway supply manufacturers had become so numerous as to warrant the formation of a formal organization which could attend to the detail arrangements of the exhibition and also to the entertainment features which were becoming an important part of the convention activities. A total

of nineteen exhibitions have been held under the auspices of the R. S. M. A. Of this number all have been held at Atlantic City, N. J., with the exception of five at Saratoga and one at Manhattan Beach, N. Y.

The exhibit in 1926 marked the advent on a large scale of the manufacturers of motor buses for highway service. The motor transport exhibition that year occupied a tent which was pitched between the track exhibits. This tent was provided with a concrete floor, 150 feet by 180 feet, which was divided into thirty spaces of different sizes. The exhibit this year not only includes a number of motor buses, but a transport mail plane, which is, undoubtedly, another indication of what we may expect to see at exhibitions in the future.

It has been fortunate that the R. S. M. A. has had men of the vision and ability to lead it up to and through this period of transition. They have acknowledged that a new problem exists through the acquisition of exhibits from the motor transport and aviation industries. Instead of a strictly railway exhibition, it has become an exposition devoted to practically all forms of transportation except the street railway and marine fields. Two years from now we can expect to see an exhibit organization functioning smoothly and effectively, perhaps under a different name, which will more adequately represent the scope and activities of the association.

A Broad-Minded Administration of Law

IN his address before the closing session of the Mechanical Division yesterday, A. G. Pack, chief inspector, Bureau of Locomotive Inspection, Interstate Commerce Commission, said: "It has been assumed by many that the cost of safe construction, safe appliances and safe repairs was prohibitive," and proceeded to reiterate his belief that this impression is erroneous.

The steady improvement made in the condition of motive power in this country since 1923, from the standpoint of conditions affecting safety, covered by the locomotive inspection rules administered by Mr. Pack, and the steady improvement in the economy of locomotive operation which has been made during the same period gives weight to this belief, which Mr. Pack has emphasized in his addresses during recent years. As he points out in his address, the per cent of locomotives inspected and found effective has decreased from 65 in 1923 to 21 in 1929, and for the first nine months of the fiscal year ending June 30, 1930, has still further declined to 17. A tremendous decrease has been effected in the number of locomotives ordered out of service. From 7,075 in 1923, this declined to 1,490 in 1929, a decrease of 78.9 per cent. The number of accidents, the number of persons killed and the number of persons injured from failures of locomotives or appurtenances covered by the locomotive inspection rules have all been in practically the same proportion. He further points out that during the same period unit fuel consumption has decreased 24.6 per cent in freight service and 19.4 per cent in passenger service.

While no data are available to show it, every railroad man knows that the same conditions which have reduced the number of locomotives ordered out of service by the inspectors under Mr. Pack's direction by almost 80 per cent since 1923 have effected big reductions in expensive engine failures of a character not necessarily resulting from conditions in violation of the locomotive inspection rules. Furthermore, most railroad men have learned—and many of them have clearly demonstrated—the fact that the more systematic methods of inspection and repair which have been developed during the past few years, not only in the engine terminals, but in the back shops as well, have exerted a powerful influence in reducing the cost of locomotive maintenance by reducing the waste of labor and material which results when efforts are directed principally to taking care of defects temporarily with little attention to permanency.

Mr. Pack refers to the fact that the position of the railroads has never been favorable to the enactment of safety legislation. It is scarcely to be expected that this attitude toward measures which seem to limit the freedom of individual managements will ever change. On the other hand, it must be admitted that no other way has yet been found by which standards of safety established by the consensus of opinion of railroads officers themselves can be made universally effective.

As Mr. Pack points out, the locomotive inspection rules have the force of law and the power of the federal government is behind them. In his administration of these rules, however, Mr. Pack has maintained a consistent policy of co-operating with the railroads. Under this policy the railroads have fully shared in the credit for the tremendous improvements of the past six years. Mr. Pack's insistence that considerations of safety and economy are inseparable has been justified. No policy of administering the locomotive inspection law on a less broad-minded basis than that established by Mr. Pack could have produced the same cordial relations between the railroads and the Bureau of Locomotive Inspection or the same whole-hearted response of the railroads in carrying out the provisions of the law.

Rationalization

"RATIONALIZATION" is a good English word commonly understood to mean reason and efficiency in thought, word or action. The dictionary also affords ample authority for believing that the word has this broad-gage meaning. It is interesting, therefore, to note that in Europe the word "rationalization" has come to convey a more specific meaning, much as "modernization" does to railroad men in this country when speaking of shops or engine terminals, locomotives or cars. In Europe, the word "rationalization" apparently means the concentration of the work of individual industries, including the railroads, in plants provided with the proper equipment and so situated with respect to the supply of raw materials and the markets that the most efficient manufacture and distribution of the products of industry will be assured. By this program, small, poorly-equipped and inefficient plants are discontinued, as is now the trend with respect to railway shops and engine terminals in this country.

Relative to this development, our English contemporary, the Railway Gazette, said in its issue of May 23: "Where, prior to grouping, several railway works were engaged in the repair and construction of locomotives, now it is the custom to confine new work to one or two main centers, carrying out repair work at these and other main centers and dispensing entirely with the smaller plants. In this way savings in equipment and labor have been realized, while better grouping of the

work shops has enabled schemes of reorganization to be carried out which have again produced further economies." American railroads have been applying the process of "rationalization" to their back shops, engine terminals and general equipment maintenance operations and it is of interest to note that similar ideas are directing progress in England.

Passenger Car Terminals

THE Committee on Shops and Engine Terminals is to be commended for the comprehensive report which was presented at yesterday's session on the design of facilities for passenger terminals. The increasing tendency toward fast and long passenger train runs has made it necessary within the past few years to devote serious attention to the provision of facilities at terminals that will permit handling cars with a minimum loss of time. The great detail in which this committee's report deals with the necessary facilities at passenger terminals, is evidence of the fact that the importance of modern facilities is recognized. Not so long ago it was considered almost a necessity to cut cars out of through trains where journal trouble had developed en route. The designer of the modern passenger terminal has found it desirable and necessary to provide facilities by means of which it is possible to perform such operations as changing wheels in the surprisingly short time of from 20 to 30 minutes, and in such cases return a car to a train with very little delay. One of the most important problems at the passenger terminal is the cleaning of cars, and the report of the committee contains a study of this work which should be of considerable value to mechanical men on roads that have not yet investigated the possibilities of mechanical car washing.

Summing Up!

THE conventions have adjourned—the big exhibit is closed, and the great halls are teeming with workers dismantling and packing. Many of the conventionites have already reached home, others are speeding across the country, and a comparatively few are impatiently doing what they can to expedite the packing and shipping of their goods.

What has been the net result of it all? Does it pay? If we judge from the statements of Chairman McManamy of the Interstate Commerce Commission, who is not given to overstatement or; from the keen interest shown by President Aishton of the American Railway Association; or from the expression of a number of chief executives and general officers who visited the conventions; or from reactions of the mechanical, purchases and stores, motor transport and electrical officers and supervisors, the question can be answered emphatically, "Yes, it has been very well worth while".

The railway supply representatives, in general, seem to be equally enthusiastic. Of course, there are criticisms —for instance, about the change from the old to the new quarters; about the humidity of the Auditorium, which seems to be just a little bit damper and more close than the air on the pier and the Boardwalk; about the shape and arrangement of the exhibit halls; about what some term racketeering on the part of the contractors and workers, because of insistence upon certain rules which appear unfair and unjustified from a commonsense standpoint, etc., etc.

Some of these criticisms are not new. They were true in the old quarters and are about equally true in all of the large cities where extensive exhibits of this sort are held. Concerning the new quarters—we could not longer remain on the pier. It was outgrown years ago. The tent for housing the motor-transport exhibit six years ago and the machinery annex across the Boardwalk from the pier four years ago, proved to be most unsatisfactory. The annex, adjoining and directly connected to the Million Dollar Pier, two years ago afforded a more satisfactory solution to the problem, but it was erected against much opposition on the part of the Atlantic City people and only in order to keep the conventions in Atlantic City and tide over until the new Auditorium could be completed. It is extremely doubtful whether the people of Atlantic City would again permit the erection of even a temporary building of that sort on the beach.

It is quite possible that from the railroad standpoint it would be wise for all of the railroads more methodically to plan to cover the exhibits, as is true of some of the roads, and more particularly of the Sante Fe. Mr. Purcell said yesterday morning that he had thoroughly covered the entire exhibit with his staff. The staff as a whole stops at an exhibit only long enough to find out whether it has something new or something that is really of interest to the Santa Fe. If so, the man most suited for studying it is detailed to make an appointment to return and cover it thoroughly, turning in a report after the convention. In this way the duty of studying and reporting upon the exhibits is distributed over the entire staff and to those who are best suited to cover particular exhibits. Other groups have done much the same thing, although not so formally and possibly not quite so thoroughly. Should it not become the practice of every road to do much the same thing? Surely, nowhere else can so many new and worthwhile railroad devices be seen and studied with so much ease and with the expenditure of so little time.

The conventions and exhibits have steadily grown in size and extent and apparently there is no possibility of reproducing the conditions of a few years ago, where closer contacts and greater intimacy were possible. We must not forget, either, that it is not the number of people that pass by a given exhibit in a given time that counts, but that it is the serious attention which interested men give to each exhibit that is really important.

The arrangement of the exhibit on the pier adjoining two long aisles, through which everyone had to pass in going to and from the Mechanical Division meeting room, created an impression of interest in the exhibit which is less apparent in the Auditorium, with its numerous aisles and two exhibit floors. There has been no lack of attention to the exhibits, however, on the part of responsible railroad officers and the relative freedom from crowds passing and repassing through the same aisles has reduced interruptions and confusion which wasted the time of railroad men and exhibitors alike.

This year's experience in the new quarters has suggested a number of changes and adjustments which will no doubt lead to more satisfactory grouping of exhibits and location of lounging facilities another year. With these adjustments worked out, there seems to be no reason to believe that the exhibit in the Auditorium will be any less effective than it has been on the pier.

Morale Builders

IS it not true that during recent years the tendency has been to transfer the emphasis in railroading more and more from equipment and facilities to the human element and human relations? This is true in industry, as well as in railroad organizations. There are not a few leaders who regard industrial supervision as a science and those who are successful supervisors and administrators as professional men, as is true of those who practice the other arts based on sciences. It is interesting to note, also, that the urge to understand the fundamental principles of successful supervision comes in many cases not so much from those at the head of the organization as from the foremen and supervisors themselves. This is exemplified in many ways—in some instances by the formation of study groups, in others by discussion groups, and in still others by a combination of these, frequently designated as supervisors' or executives' clubs. Two or three typical illustrations may not be out of place.

A few years ago a group of supervisors connected with different railroads centering in Fort Wayne, Ind., thought they would like to get together seriously to study problems of railroad organization and operation. They selected L. F. Loree's "Railroad Freight Transportation" as a good text book, and fortunately were able to secure as a leader a man who was particularly gifted, even if not specially trained for that purpose. Throughout an entire season the group met regularly, and instead of the interest falling off, as it does in some cases, practically all of its members completed the course. They organized the Fort Wayne Railroad Club, a requirement of admission being that the candidates must have taken a study course equivalent to the one that the original group had completed. After a year or so, however, it was decided to take in any member who was desirous of seriously participating in the club's activities. As a result, the club now numbers about 275 members. It has just finished an enthusiastic year's work, which included ten programs equivalent to those of the larger railroad clubs, but possibly participated in more enthusiastically because of the smaller membership and greater intimacy of its members.

On the Boston & Maine the officers and supervisors of the mechanical department expressed a desire about five years ago for some sort of an organization in which they could get together and discuss common problems and increase their effectiveness as supervisors. In this instance the management became very much interested and made it possible for one of the officers to give the time necessary to assist a series of clubs at different points on the system to build programs and hold meetings. That this movement was really worth while is clearly indicated by the fact that the clubs recently closed their fifth year with a big and enthusiastic joint dinner at Boston, the activities being participated in by President French and several of the other executives.

In a somewhat different way, and conducted almost entirely through the efforts of the local group, the officers and supervisors of the Boston & Albany at West Springfield, Mass., have been conducting a strong and enthusiastic club for a number of years. It has a monthly dinner meeting in the Railroad Y. M. C. A. building, some of the members from more or less distant points attending regularly. In this case, as in that of the Fort Wayne Railroad Club, membership is not confined to the mechanical department, and one of the noteworthy results of the club work has been the better understanding and more enthusiastic co-operation which it has engendered between the different departments, or between different parts of the same department. Men who do business by letter or over the telephone and are not otherwise personally acquainted, cannot co-operate nearly so effectively as when they know each other personally—the club meetings have done much to humanize and get the whole bunch working together on a more intimate basis.

These are only a few typical examples of movements which the supervisors have instigated on their own initiative and which are doing much to bring about letter and more intelligent methods of supervision, and at the same time are helping to develop a spirit of friendliness and co-operation within departments and between different departments. In no small sense they may be regarded as real morale builders.

Congratulations from Secretary Lamont

THE Railway Supply Manufacturers' Association, as reported in yesterday's Daily, wired resolutions to Secretary of Commerce R. P. Lamont, assuring him of its wholehearted support in the interest of bringing about more prosperous industrial and business conditions. The following telegram was received from Secretary Lamont, yesterday noon:

"The President joins me in congratulations on the success of your joint meetings and in expressing appreciation of your continued support in efforts to bring about a return to more prosperous commercial and industrial conditions. In the midst of a good deal of unnecessary gloom it is a pleasure to receive your optimistic message."

Registration, American Railway Association

Special Guests

Bohmer, W. J., For., B. & O., Kentucky
Booth, R. S., I., I. C. C., Shelburne
Buckaloo, J. M., Insp. T., Penna.
Burnham, John H., Son of Eng. of Tests, N. P., Haddon Hall
Buss, W. D., Guest of J. L. Askew, F., S. A. L.
Graeff, Geo., Asst. Foreman, Reading, Elberon
Gregg, B. M., Asst. Pipe For., Reading
Grimminger, E. W., Paint For., P. R. R.
Hoffman, Glenn, Spl. Appr., P. R. R., Princess
Hoffmaster, Scott W., C. C. to M. M., Reading, Pasadena
Houseman, F. V., Machinist, P. R. R.
Hunt, W. G., For., P. R. R.
Losh, H. C., Supt., Reading, Ambassador
Lowe, T. W., G. F., P. R. R.
Lucas, W. A., Martinique
Lutz, John J., F. E. H., Reading, Estella
Lyons, W., Jr., Erect. For., N. Y. C. & St. L., Shelburne
Miller, W. L., B. S. F., P. R. R.
Mittag, Harold, Secy. to S. C. D., C. M., S. T. & P., Ambassador
Moore, Geo. S., Machinist, P. R. R.
Moore, J. E., Pipe Fitter, Penna.
Morris, L. M., For., P. R. R.
Mouse, W. E., Blr. For., B. & O.
Murtha, Bart J., Engr., P. R. R., Irwin Apts.
Myer, Kenneth, Firing Insptr., Reading Co.
Rosenberg, Edm., Strath Haven
Rothrock, C. C., Observer, Penna.
Rudisill, Geo. G., Frt. Rep., Penna.
Russell, Lee H., C. B., Penna.
Russling, W. J., Insp., P. R. R.
Schomberg, John C., Asst. S. K., P. R. R., Traymore
Schrayer, J. L., Conductor, Reading, Estelle
Sharer, G. H., Machinist, P. R. R.
Shearer, P. D., Machinist, P. R. R.
Sheets, J. P. L., G. F., P. R. R.
Sheriff, A. B., Machinist, P. R. R.
Siddons, C., Mach., C. R. R. of N. J., Shelburne

A. R. Ayers Elected Chairman

Mechanical Division also selects O. S. Jackson of the Union Pacific as Vice-Chairman

A. R. AYERS, general manager of the New York, Chicago and St. Louis, was yesterday unanimously elected chairman of the Mechanical Division. O. S. Jackson, general superintendent of motive power and machinery of the Union Pacific System, was elected vice-chairman.

A. R. Ayers

The election of A. R. Ayers brings to the chairmanship of the Mechanical Division an officer who has been unusually active in the technical and administrative affairs of the association. Mr. Ayers is a native of and has spent most of his railroad career in the state of Ohio. He was born at Toledo, October 26, 1878, and was graduated from the Toledo high school in 1895. His technical education was received at Cornell University, where in 1900 he was graduated in mechanical and electrical engineering.

A. R. Ayers, New Elected Chairman of the Mechanical Division

O. S. Jackson, New Elected Vice-Chairman of the Mechanical Division

Mr. Ayers entered railway service with the Lake Shore & Michigan Southern on completion of his college course and served a special apprenticeship on that road. During the years 1903-05 he served as a special inspector in the mechanical department and in 1905 was promoted to night enginehouse foreman. He served some time as assistant general foreman at Collinwood (Ohio) locomotive shops and in 1907 was transferred to Elkhart, Ind., as superintendent of the locomotive shops at that point. He later returned to Collinwood as assistant superintendent of shops and again made a change of location when he was promoted to assistant master mechanic at Elkhart.

In 1910 Mr. Ayers was appointed mechanical engineer of the Lake Shore and in 1911 became general mechanical engineer of the New York Central Lines West of Buffalo and, upon consolidation of the Lake Shore with the New York Central, became engineer of rolling stock at New York.

On October, 1916, Mr. Ayers changed his railroad connections and became superintendent of motive power of the New York, Chicago & St. Louis at Cleveland, Ohio. He served in that capacity until March, 1923, when he was appointed assistant general manager of the same road, in November 1927, being elevated to the position of general manager.

Mr. Ayers has always taken a keen interest and a most active part in the work of the Mechanical Division, hav-

ing served for some time on the General Committee; on the Shops and Engine Terminal Committee, and also on the Committee on Car Construction. In 1928 he succeeded W. F. Kiesel, Jr., as chairman of the Car Construction Committee and has been instrumental in bringing to a conclusion some of the constructive work on standard cars that has been initiated by that committee during the past ten years.

Mr. Ayers' interest in railroad work has caused him to take an active part in the work of other railroad mechanical associations, particularly that of the International Railway Fuel Association. He served at one time as president of the Central Railway Club of Buffalo, N. Y.

Mr. Ayers is a member of Sigma Xi, an honorary engineering organization, as well as a member of the Shaker Heights Country Club. Mr. and Mrs. Ayers make their home in Shaker Heights, a suburb of Cleveland, Ohio. They have three children—Alice, age 17, who attends Laurel School; Samuel, 16, a student of University School, and Helen, age 8, who attends the Malvern School—all in Shaker Heights.

O. S. Jackson

With the election of O. S. Jackson, general superintendent of motive power and machinery of the Union Pacific System as vice-chairman of the mechanical division, this important position will be filled by a man of wide experience in railroad service whose genius for organization should prove an important asset in expanding the activities of the division and making it an increasing force for greater mechanical department efficiency and improved railway operation in the future.

Mr. Jackson was born on a farm near Huntington, Ind., in 1875 and at the age of 14 entered railway service as a water boy on a railroad that is now part of the Cleveland, Cincinnati, Chicago & St. Louis. Later he became a section hand on the Big Four and then entered the mechanical department of the Erie at Huntington. From 1897 to 1905, Mr. Jackson served in various positions in the mechanical department of the Big Four, then being appointed general foreman on the Chicago, Indianapolis & Louisville. In 1909 he was promoted to master mechanic at Lafayette, Ind., where he remained until 1913, when he was made superintendent of motive power of the Chicago, Terra Haute & South Eastern (now a part of the Chicago, Milwaukee, St. Paul & Pacific), with headquarters at Terre Haute, Ind.

In the following year Mr. Jackson was promoted to general superintendent in charge of both the mechanical and transportation departments, with the same headquarters. He entered Union Pacific service in September, 1921, as assistant superintendent of motive power and machinery, with headquarters at Omaha, and was promoted to superintendent of motive power and machinery in June, 1923, becoming general superintendent of motive power and machinery of the Union Pacific System in 1928.

Mr. Jackson has been a member of the Mechanical Division since 1910, contributing substantially to its work through active support of the division and membership on the General Committee, the Committee on Car Construction and the Committee on Utilization of Locomotives and Conservation of Fuel. He is a member of several clubs in Omaha and has actively supported the Western Railway Club, being a member of the Executive Committee of that body. An ardent supporter of the policy of locomotive operation involving the use of extended runs, Mr. Jackson is perhaps best known for his work in successfully introducing the system on the Union Pacific and training an organization to develop the maximum advantages from it. Mr. Jackson also initiated the maintenance program, familiarly known as "Periodical Monthly Inspection and Repairs" which has been responsible more than any other one factor for the successful general extension of long locomotive runs on the Union Pacific, as well as on some other roads.

Next to long locomotive runs, Mr. Jackson's interest has been centered recently in a successful effort to reduce the average number of locomotive days in shop and proportionately decrease unit repair costs. The shopping period for general repairs to heavy power has been cut on the Union Pacific from an average of 30 days, or more, to 16 days, with a marked reduction in repair costs and increased availability of locomotives. A man-hour schedule system for checking individual repair operations provides both the shop supervisor and the men with an accurate and highly desirable knowledge of just what is being accomplished. Mr. Jackson emphasizes the fact that he does not desire shop men to work any harder under the new system than under the old, but simply offers them the incentive of friendly competition in cutting out lost motion and wasted effort which have such an adverse effect upon shop efficiency and unit repair costs. In connection with this program for improving shop efficiency, Mr. Jackson is most emphatic in saying that satisfactory results cannot be secured without a liberal policy as regards the installation of necessary modern shop tools, machinery and labor-saving equipment of all sorts.

Under Mr. Jackson's direction, there has recently been installed on the Union Pacific some of the finest passenger-carrying equipment now used on American railways. A notable example is the Columbine train providing ultra-modern service between Chicago and Denver, Col. It is planned to extend this service in the near future and make it available between Chicago and Portland, Ore.

No mechanical or other association can achieve desired results without assuring the proper succession of experienced and competent officers to take charge of its activities, and the Mechanical Division is accordingly to be congratulated on the election of O. S. Jackson as incoming vice-chairman.

Final Enrollment Figures

THE total registration at the close of the convention yesterday, as compared with similar figures for recent years, is given in the following table. It is gratifying to note the increase in the number of railroad men who attended, although the total registration of all classes is somewhat less than it was either in 1928 or 1926.

	1922	1924	1926	1928	1930
Mechanical, Division V	1008	1223	1405	1572	1595
Purchases and Stores, Division VI	384	434	480	494	541
Motor Transport, Division VIII				56	71
Railroad guests				706	834
Railroad ladies	1036	1201	1198	1397	1229
Supply men	2304	2670	3135	2647	2536
Supply ladies	575	676	725	754	602
Special guests	947	1111	901	38	168
Complimentary				239	*
Total	6254	7315	7844	7903	7576

*Complimentary registrations this year are included in railroad guests.

Address by A. G. Pack Features Final Session

Mechanical Division closes convention with discussion of reports on shops and terminals, and locomotive utilization and fuel conservation

THE sixth and final session of the Mechanical Division was featured with an address by A. G. Pack, chief inspector Bureau of Locomotive Inspection, Interstate Commerce Commission. Mr. Pack talked on the subject of federal legislation. He reviewed the safety legislation that was passed since the original safety appliance law in 1893 which marked the first attempt of the federal government to deal with a problem providing greater safety in railroad operation. He paid tribute to the railroads who, he said, were co-operating not only as individuals, but through the several divisions of the A. R. A., in the endeavor to live up to the full requirements of I. C. C. rules and regulations. He also spoke of the important part which the railway supply manufacturers play in the railroad industry toward securing safer operating conditions.

Mr. Pack's address was followed by the report on the Design of Shops and Engine Terminals and the report of the Joint Committee on Utilization of Locomotives and Conservation of Fuel. The final business of the morning was the election of officers and members of the General Committee for the ensuing year.

Relationship between Safety and Economy

Improvement in the safe condition of locomotives since 1923 is associated with marked economies in operation

By A. G. Pack
Chief Inspector, Bureau of Locomotive Inspection,
Interstate Commerce Commission

A. G. Pack

The enactment of the original Safety Appliance Law in 1893 marked the first attempt of the federal government to deal with the problem of providing greater safety in railroad operation. Some of the specific requirements promulgated under the authority of that Act and subsequent amendments had been the subject of discussion and recommendation by the National Car Masters' Association, later the Master Car Builders' Association, since 1869, but because of the clashing of various interests material progress was not made until the federal government said, in effect:

"Because of unwillingness or inability to compose your differences and voluntarily and collectively to co-operate for the common good, it now becomes necessary to impose legal requirements to prevent further unnecessary waste of life and limb."

The original Safety Appliance Act covered train and locomotive brakes, automatic couplers, height of draw bars, and handholds or grab irons.

While the carriers strenuously opposed this and all other safety legislation, I would not construe such opposition as meaning that the carriers did not want greater safety. It has been assumed by many that the cost of safe construction, safe appliances, and safe repairs was prohibitive. This erroneous impression, together with the carriers' inability to enforce their own safety standards and requirements, and man's natural desire for freedom of action created an atmosphere of persistent, and as events have shown, ill-advised opposition to all safety legislation.

Notwithstanding active opposition encountered, the cause of safety legislation has moved forward. The provisions of the Safety Appliance Act were extended. This was followed by the enactment of the Hours of Service Law, the Ash Pan Act, and the Boiler Inspection Act.

The Boiler Inspection Act was amended in 1915 to include the entire steam locomotive and tender, thus making it the Locomotive Inspection Act. A more recent amendment brought within its purview all locomotives used on the line of any carrier subject to the Interstate Commerce Act, as amended, without limitation as to ownership or kind of power by which they are propelled.

So far as I am aware, the carriers have not changed their position with respect to the enactment of safety legislation; however, in more recent years they have, in general, co-operated with the governmental authorities in a very congenial way in carrying out the established requirements. The percentage of locomotives inspected by federal inspectors throughout the country during the current fiscal year shows the lowest percentage found defective ever recorded since the establishment of the Bureau of Locomotive Inspection in 1911, together with the fewest number of accidents, killed and injured, as a result of the failure of some part or appurtenance of the locomotive and tender, including the boiler.

Duties and Responsibility of Carriers

The Locomotive Inspection Law makes it unlawful for any carrier to use or permit to be used on its line any locomotive unless said locomotive, its boiler, tender, and all parts and appurtenances thereof are in proper

condition and safe to operate without unnecessary peril to life or limb, and unless said locomotive, its boiler, tender, and all parts and appurtenances thereof have been inspected from time to time and are able to withstand such test or tests as may be prescribed in the rules and regulations therein provided for.

The question is sometimes asked, "What is meant by proper condition and safe to operate without unnecessary peril to life or limb?" When the statute was enacted it was evidently recognized that there existed a certain peril in locomotive operation which could not be foreseen nor entirely avoided, but when the Congress used the phrase "proper condition and safe to operate without unnecessary peril to life or limb" it evidently intended to place a responsibility upon every carrier coming within the purview of the law of keeping and making its locomotives as safe as humanly possible, and that all defects which in any way imperil safety that can be discovered by a thorough and careful inspection be remedied before the locomotive is again used. The fact that this applies whether or not the rules and regulations established and approved by the Interstate Commerce Commission expressly prohibit the use of a locomotive while thus defective has been well established by decisions of Federal courts.

Enforcement

What are the duties of those in charge of the administration and enforcement of the Locomotive Inspection Law? The law requires that there shall be appointed by the President, by and with the advice and consent of the Senate, a chief inspector and two assistant chief inspectors who shall have general superintendence of the inspectors provided for, direct them in the duties imposed upon them and see that the requirements of the Act and the rules, regulations, and instructions made or given thereunder are observed by common carriers subject thereto; who shall have practical knowledge of the construction and repairing of locomotives and tenders with ability to systematize and carry into effect the provisions of the law relating to inspection and maintenance of locomotives.

The law further provides for the appointment of district inspectors whose duty it is to make such personal inspections of locomotives from time to time as may be necessary fully to carry out the provisions of the law. Their first duty, however, is to see that the carriers make inspections in accordance with the rules and regulations established or approved, and that the carriers repair the defects which such inspections disclose before the locomotives or appurtenances pertaining thereto are again put into use.

It will be observed from the requirements of the law that the carriers' duties are absolute and continuing and may not be evaded. The mere fact that a Federal inspector has not found fault with any method of inspection or repair does not relieve the carrier of the responsibility placed upon it.

Cooperation Necessary

The degree of safety contemplated by the law can be obtained only through the cooperation of the designer, the builder, the industries that furnish materials, those that furnish the various appurtenances and appliances which make our modern locomotives most efficient, and the carriers' maintenance forces in the back shop and enginehouse. The assistance of all these agencies is important and necessary but the heaviest burden falls on the maintenance forces because the results required demand continuous and never-ceasing effort—effective action in the elimination and prevention of defects which may result in failure. This is the only means by which the maximum degree of safety, reliability and efficiency in performance can be obtained. The thoroughness and promptness with which needed repairs are made means the difference between success or failure of those responsible for keeping locomotives in proper condition.

Rules and Regulations

I may here remind you that the requirements covering the construction, inspection and repair of locomotives and tenders under the law are the rules and regulations recommended and established by the best-known authorities on mechanical matters, such as your association, locomotive builders, and standard practices adopted by the railroads prior and subsequent to the enactment of the Locomotive Inspection Law, and unless the standard practices adopted and recommended by the best-known authorities are complied with the locomotive is not in "proper condition and safe to operate without unnecessary peril to life or limb," a specific requirement of Section 2 of the law. It may readily be seen that the requirements of the law are based on well-known and established practices and not on new and untried theories.

It was the failure of the carriers to comply with their own rules, regulations and standard practices that brought about the enactment of this law to be administered by government officers.

Preventive a Prime Requisite

Prevention is a prime requisite in the orderly process of reduction or elimination of defects and the back shop is the first line of defense. When locomotives are shopped for general repairs all parts should be thoroughly cleaned and inspected and all repairs needed to restore wear and place parts in proper condition should be applied in order that the locomotive may re-enter service in such condition that major renewals will not be needed during its expected term of service between shoppings.

This statement holds true regardless of whether the locomotive may or may not be of the most modern type. So long as a locomotive is to be continued in use it should be turned out after each general repair with unimpaired ability to handle its full tonnage on schedule time. After a locomotive has been placed in service constant vigilance is required in the discovery of all conditions that indicate the development of defects, and if this is carried out consistently and thoroughly and proper repairs made at the proper time serious defects will have been practically eliminated.

If locomotive and train delays must be had, the proper place to have them is at the terminal where safe and economical repairs can be made.

Proper and Careful Inspection Necessary

The trip or daily inspection and report thereof required by the Locomotive Inspection Law and Rules, adopted practically verbatim from the carriers' own rules in effect prior to the enactment of the law, enables those in charge of repairs to keep informed of the current condition of each locomotive. The value of the inspection reports in the elimination of defects depends upon the thoroughness of the inspection made, the integrity and clarity of the reports and the amount of interest displayed by the officers having jurisdiction over repairs.

It is not the purpose of the rules to permit locomotives to be returned to service with any defects constituting a violation of the law or any rule or regulation made thereunder. It is, therefore, essential that the officer charged with the duty of passing upon inspection

reports and necessary repairs have thorough knowledge of the requirements and be endowed with sound judgment in order that all repairs may be made in proper time and place and without unnecessarily withholding locomotives from service.

Systematic Procedure Necessary

Systematic procedure should be followed in routing a locomotive through the various steps after arrival, and due weight should be placed on the necessity for thorough and complete inspection.

Upon arrival of a locomotive at a roundhouse or shop terminal or as soon thereafter as possible, tests should be made for blows, pounds, and steam leaks, before the boiler pressure is allowed to drop appreciably, and all visible parts of the boiler, machinery, and tender should be thoroughly inspected and all defects found reported on the required form in an intelligent manner. Otherwise, those who are in direct charge of maintenance cannot be in a position to say to the superintendent or dispatcher at what time a locomotive in proper condition and safe to operate can be furnished for an important train.

It might seem unnecessary to say that the decision as to what repairs shall be made should not be based on expediency, but unfortunately we too often find that this is the case. A locomotive should not be permitted to leave a terminal with any defect or condition that is at all likely to cause failure while enroute.

It is generally conceded that the best results are obtained if we do not allow ourselves to fall into the error of considering small defects as of minor importance. The only safe policy is the full recognition of the fact that a potential accident lurks in the shadow of many apparently insignificant defects.

The carriers enjoying the greatest success in maintaining locomotives in a high state of repair are those having a systematic out-bound as well as systematic inbound inspection. It is a recognized principle of all successful production methods that thorough inspection of each component part, and of the assembled unit, is essential in the control of quality and therefore I emphasize inspection before and after applying repairs as a primary requisite in the process of preventing serious defects.

Many mechanical officers do not take full advantage of the opportunity afforded by the daily inspection reports to keep informed of the sufficiency or durability of repairs made from trip to trip. We too often find the same defects repeatedly reported with evidence that repairs have been attempted each time reported. This should be ample warning that the method of repair was not effective, that progress was not being made, and that time and money were being wasted. Comparison of the items reported on individual locomotives from trip to trip will point out ineffective repair methods, pay big dividends in reduced cost of repairs, and afford greater security. If a defective condition is repeatedly reported it is evident that there is something wrong. Therefore the cause should be sought and a permanent remedy applied.

Many of the large carriers have adopted what is commonly termed a periodic repair system, which consists of a thorough repair job at times of monthly and annual inspections, required by the law and rules, putting the locomotive in condition to run to the next inspection and repair period with a minimum of mechanical attention. I am of the opinion that this method of making inspections and repairs is the best system yet devised for putting locomotives in condition so as to obtain the maximum freedom from defects, maximum daily mileage and maximum reliability in service at a minimum of cost.

Cooperation and Coordination Necessary

Wherever two or more persons are engaged in any activity, cooperation is essential in obtaining the highest degree of success. Therefore, we should not neglect the human element. Good will and mutual confidence are paramount. We all do our best work under the stimulus of encouragement and approval of the people for whom we are working. The example set by those in charge goes far in producing success in whatever undertaking we are engaged in.

Leadership, teaching and training with sincere efforts to advance the legitimate interest and happiness of those whom we supervise are as essential to success as an elaborate organization or modern shop facilities, desirable as these may be.

Results Accomplished

As a result of complying with the requirements of the law, it is now being generally recognized that high standards of maintenance and safety are more economical and efficient than low standards with their consequent risk of accident and disruption of traffic movement.

Improved standards of maintenance have not only been instrumental in bringing about the greatest degree of safety of locomotive operation ever attained, but have contributed largely to the present-day dependability of passenger- and freight-train movement, increased freight-train speed, and economy in the use of locomotive fuel.

It should be remembered that during recent years the railroads have most successfully handled the heaviest traffic, both freight and passenger, in their history. The percentage of locomotives inspected found defective; number ordered out of service by federal inspectors; number of accidents resulting from the failure of some part or appurtenance of the locomotive; number of persons killed; number of persons injured; average miles per hour of trains in freight service; pounds of coal per 1,000 gross ton miles including locomotive and tender; and pounds of coal per passenger-train car mile are shown in the table for the fiscal years ended June 30, 1923, to and including the first nine months of the fiscal year ending June 30, 1930:

Trend of Locomotive Conditions, Accidents and Fuel Performance

Fiscal year ended June 30	Per Cent. of locomotives inspected found defective	Number of locomotives ordered out of service	Number of accidents	Number of persons killed	Number of persons injured	Average miles per hour, trains in freight service	Lbs. of coal per 1000 gross ton miles including locomotive and tender	Lbs. of coal per passenger-train car mile
1923	65	7,075	1,348	72	1,560	10.6	167	18.5
1924	53	5,764	1,005	66	1,157	11.3	154	17.3
1925	46	3,637	690	20	764	11.7	143	16.4
1926	40	3,291	574	22	660	11.9	139	16.0
1927	31	2,539	488	28	517	12.0	133	15.6
1928	24	1,725	419	30	463	12.6	129	15.2
1929	21	1,490	356	19	390	13.0	126	14.9
*1930	17	1,004	239	11	253	13.3	125	14.7

* First nine months.

It will be noted from the table that from 1923 to 1929, both inclusive, the percentage of locomotives inspected found defective decreased from 65 to 21, or 44 per cent; the number of locomotives ordered out of service decreased from 7075 to 1490, or 78.9 per cent; the number of accidents decreased from 1348 to 356, or 73.6 per cent; the number of persons killed decreased from 72 to 19, or 73.6 per cent; the number of persons injured decreased from 1560 to 390, or 75.0 per cent; the average miles per hour of trains in freight service increased from 10.6 to 13.0, or 22.6 per cent; the number of pounds of coal consumed per thousand gross-ton miles decreased from 167 to 126, or 24.6 per cent; and the number of pounds of coal consumed per passenger-train car-mile decreased from 18.5 to 14.9, or 19.4 per cent. This represents a real worthwhile saving.

There are fewer locomotive accidents today than at any time during the past 20 years, with a marked decrease in the number of boiler explosions and firebox failures as a result of low water and other causes. For instance, during 1912 there were 94 accidents as compared with 18 during 1929, or a reduction of 81.0 per cent; 54 persons killed as compared with 13, or a reduction of 76 per cent; and 168 persons injured as compared with 23, or a reduction of 86 per cent. During the first 11½ months of 1930 there have been 12 accidents, a reduction of 87.2 per cent; 11 killed, a reduction of 79.6 per cent, and 14 injured, a reduction of 91.7 per cent as compared with the full year 1912.

This substantial improvement has undoubtedly been brought about by greater improvement in locomotive construction, equipment, inspection and repair and because railroad officers are showing greater interest in such matters than probably ever before, with the result that locomotives are being maintained in better condition, all of which is in the interest of greater safety to the public and employee, as well as efficiency and economy in operation. I might say that there is keener competition between the railroads today in maintaining a high standard of maintenance, resulting in greater efficiency and economy, than ever before. They appear to be constantly on the alert in devising means to improve their service in every particular. These improvements are highly gratifying to me, and I know they must be to you and to every other person directly or indirectly concerned with the successful operation of the railroads throughout the United States.

The mechanical officers in charge on the railroads and the railway supply manufacturers have contributed their full share in bringing about this notable improvement and should be congratulated for their achievements by the operating and executive officers of the railroads, as well as by all others concerned in the success of railroad transportation.

I want here to thank the officers and members of this association and railroad officers generally throughout the United States, for the cordial cooperation generally given me in the performance of my duties.

Report on Shops and Engine Terminals

A complete description of a passenger terminal yard with capacity to handle 200 cars a day

W. A. Callison
Chairman

For this year's report, your committee is submitting a description of a passenger-terminal yard with all its necessary facilities. The tendency of consolidating facilities at larger terminals is ever increasing and this report, therefore, deals with a yard having capacity to handle 200 cars per day or more. The layout of such a yard depends entirely upon the area and outline of land available, topography and other conditions. It is, therefore, not practicable to show any plan. The description will be confined to the details of construction facilities and operation.

Special provisions have not been made in the report for the handling of motorized equipment, as it is thought such equipment is cared for in repair shops, in so far as the power machinery is concerned. Fueling facilities, however, are necessary in most yards to serve such equipment. The requirements for cleaning and general service are otherwise the same as for other passenger equipment.

Trackage and Platforms

It is recommended to provide a center-to-center spacing of tracks in the main part of the yard of alternately 16 ft. and 19 ft.

This spacing is based on a maximum car width of 10 ft. 4 in. The platforms, or roads between tracks, should be constructed of concrete of sufficient strength to withstand the heaviest trucking. Porous material should be used for the foundation to prevent frost breaking up the platforms. The wider of these to be 9 ft. 8 in. and the narrow one 6 ft. 8 in. in width.

The platforms should be about 1½ in. higher than the top of the rail. They should be crowned approximately 1½ in. to provide good drainage. A concrete gutter should be on each side between the edge of platform and end of ties. These gutters will be approximately 8 in. wide. They should be of round trough contour, the bottom slightly below the bottom of the ties to provide drainage of the track. If the bottoms of these gutters are 1½ in. below the bottom of a 7-in. tie, they will be approximately 15½ in. deep below platform when the rail is 90 lb. per yd. Drains should be provided at approximately 130-ft. intervals and gutters should slope to these drains at the rate of about 3 in. per 100 ft. The drain and connection to sewers should be of ample size to take care of heavy downpours. One or more wide cross roads should be provided all the way across yard to connect directly to commissary, ice storage, cleaning department, etc.

These recommendations contemplate using both narrow and wide platforms for trucking, the wider one for all servicing and supplying of material, with room for trucks to pass each other. The narrow platform is intended for such emergency truck handling as is necessary, an example being icing dining cars, changing batteries, etc. The width of this platform will not permit trucks to pass each other.

The platforms as here described provide a minimum clearance between cars of 8 ft. 8 in. and 5 ft. 8 in., respectively, both platforms extending not less than 6 in. under the overhang of the cars. This leaves a space of 2 ft. and 1 in. in between platform and rail, which is sufficient to do whatever jacking and inspection that is necessary at the car.

These platforms may also be constructed with a curbing at each side approximately 3 in. high and 6 in. wide. In such case, it will be necessary to crown the top longitudinally. The slope should be about 2 in. per 100 ft.

The drain should then be at the inside edge of the curbing. It is desirable, however, to provide drains for the tracks, which could be placed adjacent to the other drains and between the platform and end of ties, leading into a common conduit with the platform drains. It would also be desirable to provide a concrete gutter along the side of the platform to slope to these drains.

Steam, Air and Water Piping, Electric Conduits, Etc.

The facilities for steam, air and water should be laid in a system of concrete lined tunnels. The main or leader tunnel to run across the yard, in center of yard, or wherever convenience dictates. This main tunnel should be at least 6 ft. wide and not less than 6 ft. deep, with manhole entrances where necessary; also opening at one or both ends to bring in heavy pipe.

Two or more secondary longitudinal tunnels should extend from the main tunnel running parallel with the tracks. These tunnels should be not less than 5½ ft. deep and 4½ to 5 ft. wide. From the longitudinal tunnels are tertiary lateral tunnels extended the full width of the yard and spaced at 400-ft. intervals. These lateral tunnels should be not less than 4½ to 5ft. deep and 4 ft. wide, with manhole entrances in each of the narrow platforms. Manholes are placed in secondary tunnels wherever necessary. If only two longitudinal tunnels are provided, these should preferably be placed at, or near each side of the yard, so that the whole system is tied together in a loop, the pipes in lateral tunnels connecting to two or more of the longitudinal tunnels. The steam pipes are brought out of the lateral tunnels to the track with terminal fittings, valve and connection at this point only. In other words the steam connections are 400 ft. apart. A shut-off valve on each steam riser should be placed to make it possible to cut off the steam in extremely low temperatures and for repairs, such valve to have an extension handle to the surface level.

Steam lines to be carried on brackets in tunnel wall and rollers provided on long pipe lines.

Wherever the pipes are of sufficient length, expansion loops should be provided. Water and air lines are run in the tunnels in the same manner as the steam lines. The water line is to be carried above the steam line to absorb heat from it. The steam line should be covered, but it may be advisable to remove part of the covering in low temperatures to keep the tunnel sufficiently warm to prevent water pipes from freezing. The air line may be carried over the water line, or on the opposite wall. The water and air lines are brought out of the tunnels at each side of the narrow platforms to service all tracks. These lines are set on brackets on the edge of the platform, the air line over the water line. These pipes are brought to within about 40 feet of the center of the 400-ft. section, with one outlet at the end of the line, one at the tunnel and one intermediate, placing the water and air connections on 80-ft. centers along the platforms. The terminal connections are brought up over the top or edge of the platform and should be so placed and constructed as to be readily accessible. The water line should be made to drain back toward the tunnel, where a valve with an extension handle in the riser shuts off the line and drains it in severe weather. Gutters should be provided in the tunnels, leading to sewer connections, to drain water drained from water pipes and water entering accidentally.

Manhole openings are all that is required for entrance to the tunnels except the large openings to bring in heavy pipe.

These manholes, as well as the openings in tunnel roof for pipes, should have a raised collar to prevent water entering the tunnel.

Where water and air pipes cross the crossroads, it is necessary to build a trench covered with steel cover plate.

Valves should be spaced at intervals in all pipe lines so that any section may be cut out for repairs. The system, being a complete loop, prevents any other section being shut off.

The cables for charging batteries on the cars may be run in conduit in the tunnels. The conduit along the platforms may be laid in the concrete near the edge with outlets on the side of the platform on about 100-ft centers.

The electric outlets should then be at the top, recessed in the wall and protected from water with a ledge near top of platform, and with a drip plate over them. Next is the air line about 7 in. down, and the water line at the bottom about 11 to 12 in. from the top. It is also possible to run the wiring for lighting the platforms in conduit in the same manner as the other cables. Outlet boxes should be placed conveniently to make it possible to pull out any section of defective wiring.

All of these lines and charging cables are placed on each side of the narrow platforms, making connections available to any car on any track without crossing a track or a platform with cable or connection.

Facilities for Cleaning Passenger Cars Inside and Outside

The inside cleaning can be done only with direct labor and with the help of a few labor-saving devices. Vacuum or suction machines are used to some extent, as are also a syphon jet or air ejector for cleaning seats, etc. Direct blowing is also used to dislodge dust. The washing and cleaning of the car inside is otherwise done by hand.

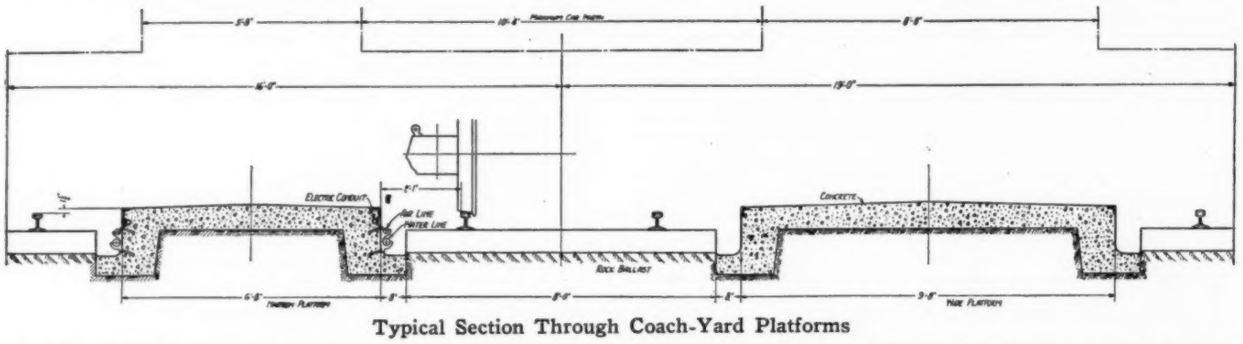
Outside cleaning is done by washing with water in which is added cleaning compounds in solution or oxalic acid. Syphon or fountain brushes can be used for washing. Lacquer finish should have special treatment at intervals to remove the gummy film of traffic. Special cleaning and polishing mixtures are used for this purpose. The car washing machine is of special interest and some of the members of your committee have made inspection of two such machines. One of these consists of two separate units. The first of these consists of a structure carrying a series of scrubbing brushes which have a reciprocating motion from the eaves to the sill of the car. The brushes are forced against the side of the car by adjustable spring tension.

A water column extends over the top of the car, from which pipes and nozzles emanate and sprays the car with water or washing solution. This solution can be sprayed into the long bristles of the brushes as they work up and down the side of the car.

The second unit consists of vertical rotating brushes which clean the windows and sides.

The car is slowly moved through the first and second unit at the rate of about two minutes for the car to pass a given point.

The second machine inspected is somewhat similar to the first one described, except that it is not equipped with the reciprocating brushes. The location of such a machine is of vital impor-



Typical Section Through Coach-Yard Platforms

tance and should be so arranged that the minimum number of switch engine hours is required to handle cars through the plant; otherwise the saving in labor over hand washing can easily be offset by excessive engine hours.

Your committee was unable to obtain actual cleaning cost by the hand method to compare with the machine method sufficiently accurate to warrant submitting comparative costs at this time, but some figures as given will give an idea of saving effected.

The cost of ordinary hand cleaning in one case was $1.80 per car, and the cost of machine cleaning $1.25 per car, which latter includes interest and depreciation, cost of electric current, water, oxalic acid, maintenance of plant, etc., but does not include any cost for switching of cars through the plant. This latter item of expense, when included, will not leave much balance in favor of the machine-cleaned car unless the switching hours are greaty reduced over that witnessed in the operation in these plants. It is also the opinion of this committee that the minimum number of cars cleaned, to justify the installation of this apparatus, would be approximately fifty a day.

In certain regions it appears that it would not be adaptable to all seasons of the year unless the apparatus was housed and heated; otherwise, during severe freezing weather the water sprayed on the car would undoubtedly freeze around the vestibule doors, windows, hand holds and steps, and create an undesirable and unsafe condition.

Methods of Handling Ice and Supplies

Tractors and trailer trucks are generally used in handling all materials over the concrete runways or platforms.

There has lately been placed on the market, a power truck of the electrically driven, high lift, platform type. This truck is constructed with heavy upright columns on which the plat-

form slides. The uprights permit the platform to be raised to a height of 10 ft. at a speed of 15 ft. per min. Upon the elevating platform itself, has been built a box or ice container capable of carrying seven 400 lb. cakes of ice. A hand rail and grating walk have been built around the box for the man to stand on with perfect safety when unloading ice. The truck is served by two men and can travel at a speed of eight m.p.h. The carrying capacity of the truck is six thousand lb., but as mentioned before, the ice capacity is about three thousand lb. The truck is lowered to the height of the ice house platform and upon reaching destination is raised to the height of the vestibule platform; where such equipment as coaches are iced (this ice may be cracked and in buckets). On equipment having ice hatches, such as diners, the platform is raised to such height. The man on the platform chops the ice into much larger pieces than the old method permitted, and the operation is therefore speeded up considerably. It is claimed that in some cases the 400-lb. ice cakes can be loaded whole in diners.

The claim is made that a crew of two men with this power lift truck can ice as many cars in two hours as four to six men are able to do in a day. In addition the lift truck may be used for many other purposes, such as loading material in and out of cars, where the truck platform can be raised to the level of the vestibule platform. The truck when available, could also be used to assist men when necessary to do work over the top of cars. In other words, such a truck can be kept in constant operation.

Facilities for Handling Wheels and Trucks

The shop facilities may be either at the end or adjacent to the tracks, on one side of the yard, depending upon the yard layout. The first will be designated here as The End Arrangement and the second as The Side Arrangement. In a yard of this size, at least three tracks, at the shop location, should be assigned to repair work, removing wheels, trucks, etc. Two or more of these tracks should have two drop pits spaced at approximately truck center distance of a passenger car, disposed and extended under the working track and two additional tracks for wheel handling, so that these pits form a continuous trench transversely under the tracks. These pits should be well drained and have a track in the bottom, equipped with a wheel track. At each intersection of surface track, should be well constructed and safe removable gap rails and air lifts to take wheels in and out of the pits. The wheel-handling tracks should connect to wheel storage tracks in the yard, or some layouts may be arranged with a mono-rail system for wheel handling. There is an advantage in the mono-rail system that wheels can be lifted over the other wheels, thus eliminating labor. The arrangement of drop pits can be worked out in largely the same manner with the end arrangement as with the side arrangement. In large yards, it may be found desirable to install a power car lift, to lift the car off its trucks.

Where it is desired to bring trucks into the shop, it is necessary to install truck turntables, to move from car lift track to the shop. These turntables will be needed on both ends of the car with the side arrangement, while with the end arrangement, the car lift track may be run directly into the shop from one end of the car while the truck from the other end would be handled on turntables. It is also possible to use an overhead crane arrangement to handle trucks where the magnitude of such work warrants it. Some yards are arranged with surface or overhead repair tracks with a basement story underneath, containing all wheel and truck shop facilities. Arrangements to drop wheels through from the repair level is made in this layout.

Arrangement should be made for wheel loading and unloading tracks, either depressed track or where mono-rails or cranes are handling wheels, such systems may be extended to do loading and unloading. It is not possible to lay down definite lines for many of these arrangements; they depend upon size of the business, location and other local conditions of the yard, as well as available capital.

Ice Plant or Ice House

The estimated ice requirements predicated on this side of the yard should not be in excess of 20 tons per day, in the warmer season. On this basis, an ice storage capacity of approximately 6,000 tons would be necessary. The cost of natural ice varies greatly, according to local conditions—an average cost of one dollar per ton in the house, is believed to be a very low figure. It may be very difficult to obtain a reliable natural ice supply at a reasonable cost, in many locations, and consideration should therefore be given to an artificial ice plant. If the maximum requirements are 20 tons per day, a 40-ton refrigerating machine will be required, and at a fair average of 1½ hp. per ton of refrigeration, would require 60 engine horsepower.

Assume that in the power plant to serve this yard, it is necessary to furnish steam at all times and that steam-driven air compressors are used to furnish air for the yard, it would necessitate having men in attendance of such machinery at all times, it should then be possible for such personnel to attend the refrigerating machine, without special attendants for this service. This refrigerating machinery, should in such case, serve all departments in the commissary, requiring refrigeration.

While it is not possible to give comparative cost between artificial and natural ice, it is the belief of this committee that under the circumstances and under the conditions as given, in the foregoing, artificial ice in quantities required for a yard of this size, or larger, will cost but little, if any more than natural ice and in many cases would be cheaper. Artificial ice also has many advantages, for use in passenger equipment, and can be manufactured from a controlled and safe water supply. There is the added advantage in manufacturing ice, that it is helpful in some measure of balancing the power load; the demand for ice being heavier in the warm season, when there is a small or no heating load.

Power Plant

The power requirements for a yard of this size and to serve the maximum demand, are estimated to need an initial installation of 1,400 b. hp., if the location is north of the fortieth latitude; south of that line 30 per cent less should be sufficient.

Such a plant may consist of, for example, four 350 hp. water tube stoker-fired boilers, allowing for the cleaning of alternate boilers, which need not be of the high-pressure type. As the heating load and similar service is predominant, a pressure of 125 lb. gage is sufficient. With the exception where electric power rates are very low, it will be more economical to use steam-driven compressors. A total installation of 1,800 cu. ft. per min. capacity and 100 lb. gage pressure would be sufficient for all purposes. The proportions of this equipment increase, somewhat in proportion, to the size of the yard.

If an artificial ice plant is contemplated, the refrigerating machine, air compressors and other machinery may be assembled in one machine room, so that all can be attended by one man. The exhaust from such engines can be used in heating all buildings in the yard in the cold season. In this machine room should also be installed a motor-generator set to furnish current for charging batteries in the yard and battery room, as well as switchboard control and pump apparatus.

It is assumed that electricity is not otherwise manufactured, except perhaps in very large yards.

Facilities for Handling Lubricants, Etc.

The oil house should be of fire-proof construction, and laid out with track facilities and apparatus to unload oils, etc., from cars with the least expenditure of time and labor. Highly inflammable materials to be in covered under-ground tanks. Metering and recording dispensing pumps are now generally used and need not be described.

Except in very large yards a waste reclaiming plant is not recommended. There is some difference in materials used for packing passenger cars, some roads using only wool waste. It is therefore, necessary that the oil house be equipped to handle materials to suit all roads using the yard.

Where motorized equipment is served, it would perhaps be advisable to have a filling station convenient to an outgoing track. Such filling station should be equipped to refill lubricating oils as well as fuels.

Cleaning Plant for Carpets, Upholstery, Etc.

It is the opinion of this committee that the periodical heavy cleanings of carpets and upholstery are mostly done at shop points. However, if facilities are found necessary at the coach yard to do this work, a separate room or building should be provided for this purpose.

Upholstery can only be cleaned by suction, blowing or beating and spots can be removed therefrom. The washing of materials is usually done at the time extensive repairs are made.

There are machines on the market for the beating and cleaning of carpets. One of these consists of a series of brushes over a frame with suction pipes to remove the dust, a revolving shaft fitted with belts or swinging straps doing the beating. If there is sufficient dust to be a menace to the health of the employees in this department, it would be necessary to place suction fans to remove the dust or provide employees with dust-catching masks.

Mechanical Shop Facilities

It is important that the wheel and truck shop be in a handy location in relation to the repair section of the yard. The machine

or wheel shop should be housed in a substantial brick or concrete building. For this size of yard, it should contain a minimum of one tire turning lathe; one journal truing lathe; one journal bearing broaching machine; one drill press; one emery grinder; air tools and small tools.

Other facilities to be provided in connection with the shops and which could as well be housed in the same building are as follows: Air brake shop; electric shop; blacksmith shop; battery rooms for washing, repairing and charging; carpenter shop and offices for mechanical forces.

The shops should be equipped with mono-rail systems or electric or compressed air hoists to handle heavy materials wherever found advantageous.

Handling of Batteries and Electrical Equipment

Batteries and other electric light equipment should be thoroughly overhauled at the regular shopping periods. It is, however, necessary to make provisions for the upkeep and handling of batteries in the terminal yard. The conveying of electrical equipment from one place to another, requires several types of small vehicles.

The repair section should be equipped with a mono-rail system for handling generators from trucks to benches. Battery rooms should, where practical, be constructed of, coated and equipped with materials that are acid resisting. The principal division of battery and electric shop to be about as follows:

A separate wash section for batteries.—Where acid and alkali batteries are both in use, there should be a separate wash section for each kind. Hydrometer, test tubes, etc., used for acid should not be used in the alkali section, and vice versa, because of the injurious effect, of one kind of solution on the other. The washing and cleaning section should have benches, each large enough to hold one car set of batteries. The benches to be about six feet apart to provide room to work between them. The number of benches to be double the number required to accommodate cells for the highest number of cars, liable to be required in one day. Vulcanized rubber pails should be provided for receiving the old acid from the cells. An inclined lead gutter, extending along the far ends of the benches should receive the old acid from the pails, after it has passed the impurity test and convey it to a lead lined settling vat, from which it should overflow into a storage vat, where it is again brought to required strength.

The section for the alkali batteries is to be fitted up in similar manner, except that the settling vats are made of iron. Provision should be made to care for cell containers such as lead-burning equipment, etc., and the battery repair section to be separated from the washing and charging section. This section provided with racks for leaden and rubber containers, vats or pots for heating paravax and asphaltum. There should also be racks containing fittings and plates and other parts used in repairing cells.

A separate charging section for batteries is required.—Where acid and alkali batteries are both in use, there should be a separate section for each kind. Benches in the charging section to be similar to those in the wash section. The cells on each bench should be connected in series and then put on charge at the switchboard; the gravity being corrected during the charge. All cells should have discharge tests made by permanent wiring from switch-board equipped with necessary rheostats, etc., or by portable discharge panel having an ampere-hour meter, an ammeter and a set of resistance grids. Cells which pass the test should then be fully charged for service.

The charging section should be well equipped with revolving fans located in the side walls or windows in order to remove by suction the gases and spray arising from the batteries while being charged. Care should be taken to prevent any naked flames being exposed in a charging room on account of the explosive nature of the hydrogen and oxygen gases arising from the cells. The temperature of the room should be kept as near as possible to 70 deg. F. because gravity of solution in cells quickly changes with rise and fall of temperature.

A machinery section is required for generator and general repairs, and should contain the following machines: A lathe, power hack saw, drill press, grinding wheel, threader, shaper, portable air motor, portable electric drill, conduit-pipe bender, coil former and a taping machine. Other equipment should include an overhead traveling air hoist for lifting generators on and off trucks, benches and test frames. Benches about 30 in. high, 27 in. wide, 12 ft. long and covered by ¼-in. steel plate to enable generators to be turned easily or slid around; test frames with variable-speed motors capable of testing generators at all speeds up to 60 m. p. h., test rack with voltmeters, ammeters and an ampere-hour meter for regulators, and racks or shelves for spare parts.

Sanitation

Passenger coaches should not be permitted to leave a terminal unless very cooler has been cleaned and steamed not longer than six days previously. Coolers, including lids, should be washed out thoroughly and steamed in a steam box for at least three minutes. The coolers should be taken from the steam box to the cars in a canvas covered truck. On no account must coolers be touched by hands inside after they are steamed.

A room should be arranged for all disinfectants, cleaning material and apparatus as may be required. An up-to-date wash room, toilet facilities, as well as medical first-aid rest room, must not be forgotten.

Air-Brake Testing

The air-brake shop should be fitted up with necessary benches, tools, and A. R. A. test racks as required, which need not be described here.

An air brake test line should cross the entire yard at each end near the leads, so as to facilitate the testing of trains at fixed points. This line should lie approximately at the end of the concrete platform. Storage reservoirs should be provided, to stabilize the pressure in the line, such reservoirs to be of ample capacity for lengths of trains tested. These reservoirs should be designed to trap all condensation out of the line, keeping it out of the train line as much as possible. Standard testing devices should be available at each end of the yard.

Dining-Car Commissary

A dining car commissary building is for the purpose of economically purchasing, storing and handling of all commodities used for servicing railway dining cars such as perishable and non-perishable foods, linens, silverware, dishes, cooking utensils, etc., and should be of fireproof construction.

The building should be designed efficiently for the handling of such commodities, and should be conveniently situated with respect to the coach yards where trains are cleaned and made ready for service. Also, it should be so arranged that truckloads of supplies may be unloaded. A platform for loading and unloading should be constructed for handling of supplies to and from freight cars, refrigerator cars and dining cars.

The following description is of a recently constructed building which would meet the requirements of a modern dining car commissary with laundry in connection; also houses dining-car department officers, clerical staff and auditing staff:

The structure is 48 ft. 8 in. by 161 ft. with four stories and full basement. It is of reinforced concrete with brick exterior walls and tile partitions inside. Floors in the commissary and laundry are plain surfaced concrete, while the floors in the offices, crew and locker rooms, corridors and public spaces are finished with mastic. Steel sash is used throughout, except in the offices. An automatic elevator, with a capacity of two tons, serves all floors.

In the basement, storage space is provided for reserve stocks. A large fruit and vegetable room for the long-keeping type, such as potatoes, apples, carrots, etc. There is also a room for the storage of smoked meats. A smaller room is also provided for the ripening of melons, bananas and citrus fruits. All of these rooms are served by a ventilating system, whereby clean fresh air is drawn from outside and heated or chilled, then distributed through an arrangement of underground ducts.

The storage cooler and freezer rooms are also located in the basement. The temperature of the freezer room is maintained at zero, and the storage cooler rooms at 35 deg. F. Access to these rooms is through a vestibule of the same construction and temperature to prevent the inrush of warm air each time the refrigerator doors are opened. The refrigerator machinery may be housed in the basement.

An incinerator is provided for the sanitary disposal of garbage, etc. Charcoal for fueling dining cars is also stored in a room in the basement.

The commissary occupies the entire first floor and the basement. At the front of the building, facing the driveway, is the receiving room for truck deliveries. A platform scale is provided for checking weights of all material received. On the first floor are located refrigerator rooms for meats, fish, fresh vegetables, and dairy products. Entrance is through vestibule of the same type as used in the basement. A temperature of approximately 35 deg. F. is maintained in these rooms. Adjoining the meat refrigerator is a meat cutting room, for trimming and preparation of cuts.

Special rooms have been constructed and equipped with shelving for the safe keeping of silverware, china, glass ware, and cooking equipment. Bottled beverages, cigars and cigarettes are stored in spaces especially designed and constructed for that purpose. The floor of the room where cigars are stored is covered with porous brick which is kept moist to provide proper humidity.

Steel shelving, racks, bins and cases have been installed for canned goods, staple groceries and bakery goods. All of these commodities are within easy reach for the assembling of sup-

plies at the car make-up counter for the complete stocking of dining cars. All materials requisitioned for a car are collected or assembled at the make-up counter where it is checked by the steward in charge of the car, then carried on trailers by tractor into the coach yard to the diner. The make-up counter is partitioned off with wire mesh into several spaces or lockers, and arranged so that it is unnecessary for employees of dining cars to enter the stock room.

A salad kitchen is provided for the preparation of soup stocks, salad dressings, etc. An instruction room is also provided on the first floor, in which is incorporated a regulation dining-car kitchen, pantry, and the first two tables within the dining room, for the purpose of instructing cooks, chefs, and waiters.

At the rear of the commissary, a platform has been constructed between two tracks providing space for four dining cars which permits supplies to be handled directly to the dining cars, and which also can be used for loading and unloading of supplies from freight cars, refrigerator cars, etc.

Office for commissary agent is provided, and is so located that it gives him clear vision of all activities.

The laundry occupies a portion of the second, third, and all of the fourth floor. After linens are ironed and folded, they are put in bundles and sent to the linen storage room. A linen repair room is provided on second floor; also the office for laundry manager, rest room and toilets for women employees of the laundry. Similar rooms for men employees of laundry are located on third floor.

Offices for the superintendent and assistant superintendent of dining cars, as well as the clerical staff, including stationery storage and file rooms, are located at the front on the second floor. Separate locker rooms with lavatory and locker facilities have been provided for the stewards, white chefs and cooks, colored waiters and porters. Men's and women's rest rooms have been provided for the office forces separate from the laundry and road employees.

The accounting offices are located at the front on the third floor, and are provided with record file and stationery supply room. All partitions that divide the office portion from the laundry have been insulated to make soundproof.

Large water tanks have been provided on the fourth floor for supplying the needs of the entire building. Water softeners are located in the basement. Soap vats are located on the fourth floor and the solution is piped directly to the washing machines.

Yard Lighting

It is the opinion of your committee that flood lighting is the most efficient form of lighting for passenger car train yards.

The report was signed by W. A. Callison (chairman), superintendent motive power, Chicago, Indianapolis & Louisville; J. M. Henry, assistant chief of motive power, Pennsylvania; B. P. Phelps, engineer of the shop extension, Atchison, Topeka & Santa Fe; J. A. Brossart, general master car builder, Cleveland, Cincinnati, Chicago & St. Louis; J. Burns, works manager, Canadian Pacific; G. F. Hess, superintendent motive power, Wabash, and A. M. McGill, assistant superintendent motive power, Lehigh Valley.

Discussion

L. Richardson (B. & M.): Even in Boston, where the spread between natural and artificial ice is better than any place in the country, we find it advisable to go to artificial ice. A tie-up was made with the local ice company where the production of ice was under commercial conditions, which is much better than for the railroads to go into the business of manufacturing ice.

In the matter of washing machines we have been trying for a number of years to get a washing machine put in, but the shifting time in the yards makes it difficult. In the new passenger yards at Boston the matter of shifting is of paramount importance. When you can lay out a yard where you can shift the cars in and out easily you will save a lot of money.

Chairman Ayers: A member has raised a question that is a little outside of passenger car cleaning, but he would like to know whether anyone here has had experience in washing engines by machine. It is understood that there are some terminals that do that, using a mechanism somewhat of the order of that used for passenger cars. If anyone has knowledge of the operation of such an outfit we would like to hear from them.

If there is no discussion a motion is in order to accept the report of the committee and print it in the proceedings.

(*A motion to accept the report was made and carried.*)

Report on Utilization of Locomotives

This report, which includes fuel performance figures, demonstrates the need of more multiple-crew runs

W. H. Flynn
Chairman

No field surveys were made by the sub-committee during 1929. Accumulative quarterly reports for the first three quarters of 1929 were issued; the last quarterly report is combined with this annual report.

Volume and unit data are shown in this report to indicate trends and factors by years for Class 1 carriers as a whole, and for 26 selected carriers in some instances.

Analyses have been divided between freight, passenger and yard service.

Data sheets (not included in this abstract) give data for each Class I carrier for the years 1928 and 1929. Sheets 1 and 2 show freight service; sheet 3 covers passenger service; sheets 4 and 5 cover selected items for 26 individual carriers.

Freight Service—Volumes and Unit Performances

Table I shows the volumes in relation to traffic handled by Class 1 carriers from 1920 to 1929, inclusive.

Table I—Freight Volumes in Relation to Traffic Handled

Year	Gross ton-miles trailing (000,000)	Train-miles (000)	Train-hours (000)	Loco-miles (000)	Tons fuel used (000)
1920	913,851	633,527	61,429	718,605	89,925
1921	760,716	530,141	45,950	594,825	70,303
1922	813,741	555,789	50,267	624,963	75,694
1923	987,326	641,555	58,897	725,666	90,263
1924	954,072	600,662	52,258	673,351	81,025
1925	1,023,370	612,680	51,988	689,572	81,316
1926	1,098,985	632,927	53,112	714,323	85,095
1927	1,086,872	610,576	49,537	689,258	80,427
1928	1,105,890	602,434	46,860	680,996	79,313
1929	1,141,619	611,919	46,497	692,799	80,817

Chart A (not shown) reflects the trends for Class I carriers as a whole in percentage fluctuations each year compared with 1920.

Table II shows the trend in unit performance for Class I carriers as a whole, by years.

Table II—Trend in Unit Freight Performance for Class 1 Carriers

Year	Train speed	Tons per train	Gross ton-miles per train-hour	Av. t. e. p. per loco.
1920	10.3	1,442	14,877	41,443
1921	11.5	1,435	16,555	42,065
1922	11.1	1,464	16,188	42,627
1923	10.9	1,539	16,764	44,675
1924	11.5	1,588	18,257	46,060
1925	11.8	1,670	19,685	46,930
1926	11.9	1,736	20,692	47,672
1927	12.3	1,780	21,940	48,634
1928	12.9	1,837	23,600	49,553
1929	13.2	1,866	24,553	50,066

Terminal to terminal train speed was 28.1 per cent greater in 1929 than in 1920. Continued improvements are brought about in (a) train assembly and pre-classification, resulting in the amount of road switching increasing less than cars per train; (b) reduction in intermediate yard frequency work; (c) dispatching; (d) reduction in relative number of stops for fuel and water by

the use of larger tenders; (e) increased lengths of automatic or controlled manual block systems; (f) increase in lap slidings; (g) increase in remote control switches; (h) installation of adequate sidings, yards, etc., to take full train lengths. This speed factor, however, does not indicate running speeds and is affected by road switching.

Trailing gross tons per train increased from 1,442 in 1920 to 1,866 in 1929, or 29.3 per cent. Compared with this, the average tractive effort pounds per freight locomotive increased from 41,443 in 1920 to 50,066 in 1929, or 20.8 per cent. The total trailing gross ton miles increased 24.9 per cent in 1929, so that the improvement in train tonnage was greater than the influence of traffic volume.

The hourly speed-load factor, or gross ton miles per train hour, was 65 per cent greater in 1929 than in 1920. As a result of this trend, the total train miles were 3.3 per cent less, the total locomotive miles 3.6 per cent less, and the total train hours 24.3 per cent less in 1929 than in 1920, representing direct economics.

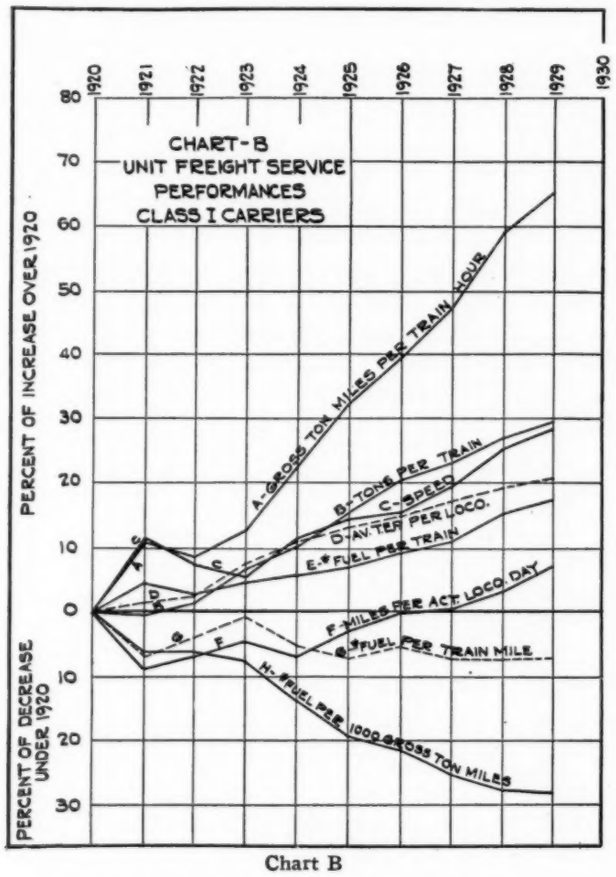


Chart B

As compared with the hourly rate of work per active locomotive, the daily rate in gross ton miles per active locomotive ranged as shown in Table III.

Table III—Hourly and Daily Rates of Work per Active Locomotive

Year	Gross ton-mile per train-hour	Gross ton-mile per active loco day
1920	14,877	108,119
1921	16,555	99,930
1922	16,188	100,450
1923	16,764	100,794
1924	18,257	112,833
1925	19,685	122,253
1926	20,692	130,849
1927	21,940	134,938
1928	23,600	142,832
1929	24,553	150,318
Per cent increase 1929 over 1920	65.0	39.3

It is not expected to increase the amount of work per day the same as the increase in amount of work per hour, if approximately 5 per cent of all runs remain on a single crew basis. If the gross ton miles per active locomotive day were to have increased 65 per cent in 1929 over 1920, this would amount to 178,396, as compared with the actual of 39.3 per cent, or 150,318.

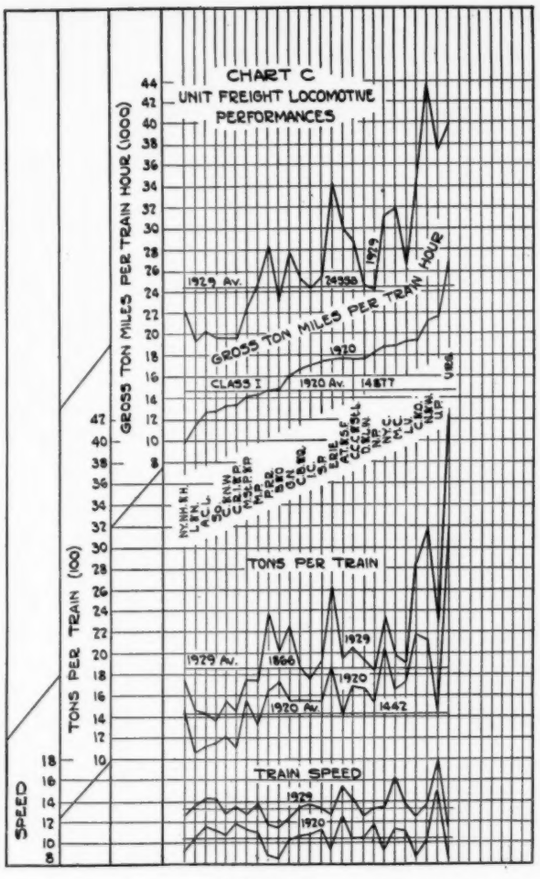


Chart C

At that high rate and the same speed and train tonnage as prevailed in 1929, it would have required 7.26 hrs. per day on trains, plus approximately 1.3 hours of road switching, or a total of 8.56 hrs. per locomotive. The only method of avoiding the

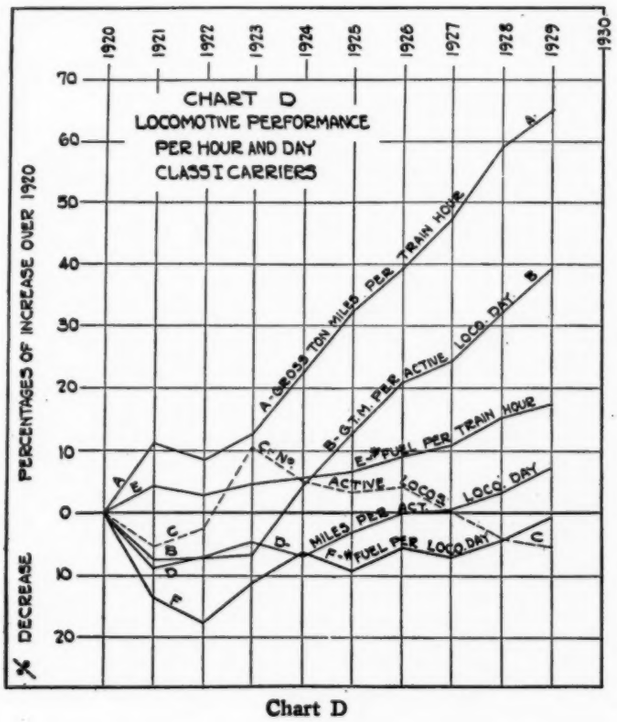


Chart D

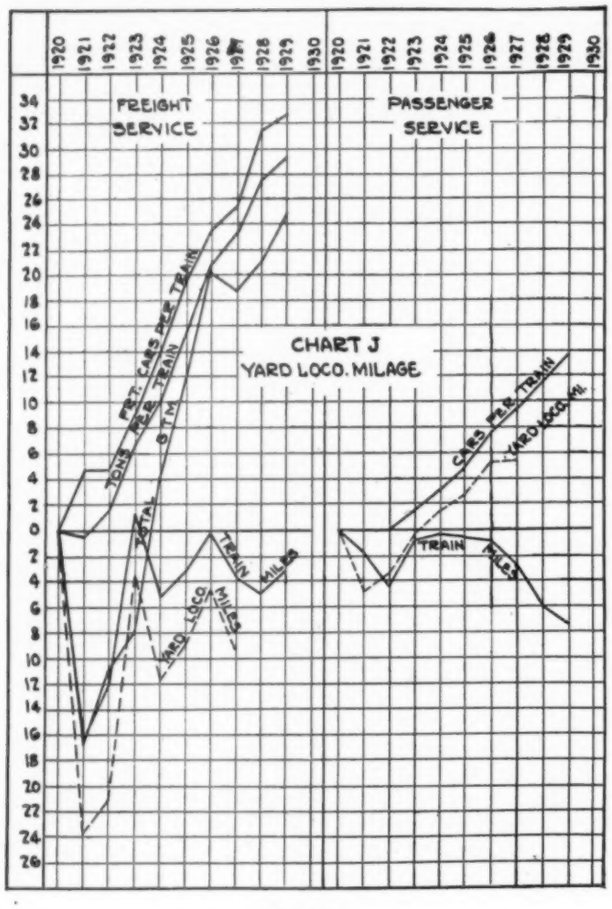


Chart J

excess of standard bases is to increase the number of multiple-crew runs or trip frequency per day.

Trends in percentage fluctuations from 1920, by years for Class I carriers, are shown on Charts B and D.

Freight locomotive mileage is reported on the OS-A reports, divided between principal, helper and light, but excluding road switching. An analysis of road switching mileage has been made by years for Class I carriers, and is now added to locomotive performance as to mileage and hours of service. This is shown in Table IV.

Table IV—Miles and Hours per Active Locomotive Day

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Principal	helper and light	Light	on trains	Road switch	Total	Total less light	On train	Road switch	Total less light
1920...	85.2	10.3	74.9	6.3	91.5	81.2	7.27	1.05	8.32
1921...	78.1	8.5	69.6	5.7	83.8	75.3	6.05	.95	7.00
1922...	79.2	8.7	70.5	6.0	85.2	76.5	6.46	1.00	7.46
1923...	81.5	9.4	72.1	6.2	87.7	78.3	6.50	1.03	7.53
1924...	79.4	5.4	74.0	6.4	85.8	80.4	6.43	1.06	6.49
1925...	82.3	8.9	73.2	6.6	88.9	80.0	6.20	1.10	7.30
1926...	85.1	9.9	75.2	7.2	92.3	82.4	6.33	1.20	7.53
1927...	85.5	11.1	74.5	7.3	92.8	81.7	6.05	1.21	7.26
1928...	88.0	10.1	77.9	7.7	95.7	85.6	6.04	1.28	7.32
1929...	91.2	10.7	80.5	7.8	99.0	88.3	6.10	1.30	7.40

The data in column (1) is that heretofore reported as miles per active locomotive day, consisting of principal, helper and light, but excluding road switching. The data for light locomotive miles per active locomotive day indicates a considerable excess over that incurred moving between roundhouse and train, and therefore is largely as a matter of return helper and locomotive redistribution mileage. Conservation of light mileage is recommended.

The locomotive train milage is shown in column (3), and road switching in column (4). Column (5) is the total light, train and road switching mileage per active locomotive day, which reached 99 miles per day in 1929 to obtain 88.3 miles on train and in road switching. The hours per active locomotive on trains was 6.10 in 1929, and this plus 1.30 hrs. in road switching showed a total of 7.40 hrs. per day, excluding light mileage. This emphasizes the fact that as the total single-crew runs approach a duration of eight hours per day, the extension of hours and miles per active ocomotive day should be further accomplished by multiple-crew runs and quicker return trips on short runs.

Trends of the 26 selected carriers are shown on Chart C as to train speed, tonnage and gross ton miles per train hour. This shows a continued increase in each of these factors. Chart E (not shown) gives the performance of miles per active locomotive day (principal, helper and light, but not road switching) and the work per day in gross ton miles per active locomotive. Some carriers had a decrease in mileage performance, but all these carriers had an increase in gross ton miles per active locomotive day because of increased tonnage and speed per train.

Table V—Distribution of Locomotive Hours

	(1)	(2)	(3)	(4)	(5)	(6)
	On train	Road switching	Terminal detention	Road light	Total	Unaccounted for
1920..	7.27	1.05	10.50	.78	19.60	4.40
1921..	6.05	.95	10.50	.70	19.20	4.80
1922..	6.46	1.00	10.50	.72	18.68	5.32
1923..	6.50	1.03	10.50	.79	18.82	5.18
1924..	6.43	1.06	10.50	.39	18.38	5.62
1925..	6.20	1.10	10.50	.64	18.44	5.56
1926..	6.33	1.20	10.50	.84	18.87	5.13
1927..	6.05	1.21	10.50	.96	18.72	5.28
1928..	6.04	1.28	10.50	.86	18.68	5.32
1929..	6.10	1.30	10.50	.92	18.82	5.18

Table V shows the hourly distribution daily per active freight locomotive, based on our estimated average daily terminal detention of 10.5 hours, as explained in the 1929 report, the hours

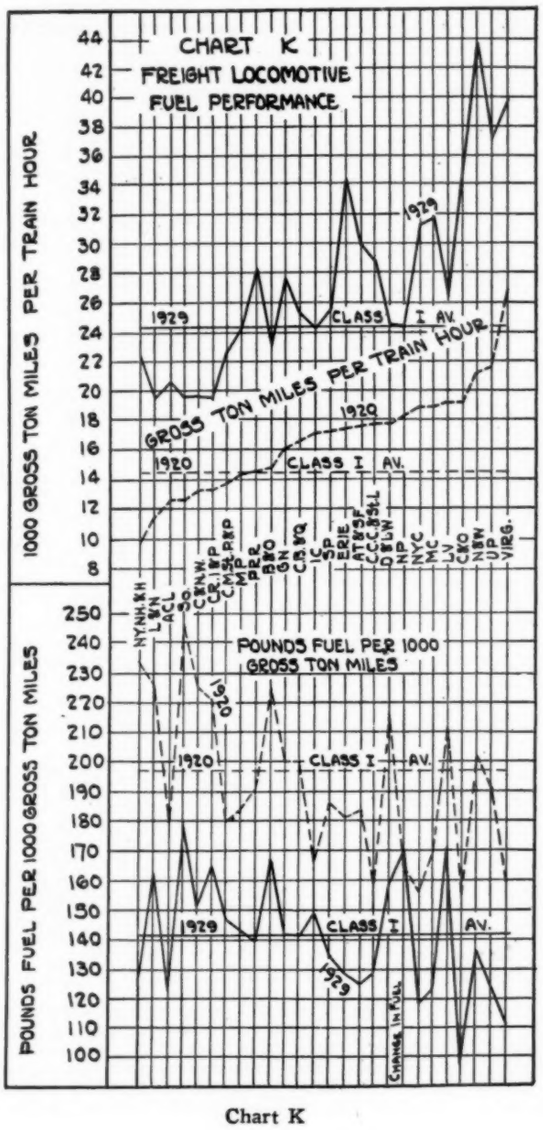


CHART K
FREIGHT LOCOMOTIVE FUEL PERFORMANCE
1000 GROSS TON MILES PER TRAIN HOUR
GROSS TON MILES PER TRAIN HOUR
1929
1920
CLASS I AV.
POUNDS FUEL PER 1000 GROSS TON MILES
POUNDS FUEL PER 1000 GROSS TON MILES
NYNH&H LV&N ACL SO C&NW CR.I&P CM&StP MPR BRO GN C&EI SP ERIE AT&SF CCC&StL D&LW NP NYC MC LV C&O N&W UP VIRG.
CHANGE IN FUEL

Chart K

on train plus road switching, and the resultant non-productive hours per day.

The estimated items of terminal detention and road light hours vary considerable from the estimated averages, so that the unaccounted hours are estimates. This table differs from former statements in that it includes estimates for road switching and light locomotive time.

The length of the single-crew runs is limited by the mileage and hour basis for crew compensation. Therefore, increasing the average performance can be best accomplished by multiple-crew runs to a greater extent than the present estimated 5 per cent of the total. When through runs are not practicable, an increase in number of locomotive trips per day will assist in bringing about further improvement, and former recommendation to condition the locomotives at main terminals and give minor attention at terminals where layover time is short will make quicker return trips on short runs feasible.

Number and Condition of Freight Locomotives

Table VI shows the number of freight locomotives reported in the OS-A basis for Class I carriers by years.

Table VI—Freight Locomotives Reported on OS-A Basis, Class I Carriers

	Total	Unserviceable	Serviceable	Stored	Active
1920.....	30,080	7,318	22,762	669	22,093
1921.....	32,936	7,906	25,030	4,190	20,840
1922.....	32,940	8,404	24,536	2,932	21,604
1923.....	32,966	7,123	25,858	1,478	24,365
1924.....	33,240	6,237	25,843	3,771	23,232
1925.....	32,419	5,756	26,663	3,719	22,944
1926.....	31,652	5,193	26,459	3,448	23,011
1927.....	30,997	4,901	26,006	3,927	22,079
1928.....	30,242	4,939	25,303	4,184	21,119
1929.....	29,131	4,776	24,355	3,537	20,818

Comparing 1929 with 1920, this shows a decrease of 3.1 per cent in total number of locomotives, an increase of 6.9 per cent in number serviceable, a decrease of 34.8 per cent unserviceable, and a decrease of 5.7 per cent in number active. The decrease in total number of locomotives of 3.1 per cent was brought about by a decrease of 3.3 per cent in train milage and number of trains run of heavier tonnage and greater speed. The ratios to total for serviceable, unserviceable, stored and active show imper cent. and tons of fuel consumed decreased 17.2 per cent.

Passenger Service Volume and Performances

Passenger service volumes of Class I carriers fluctuated as shown in Table VII.

Table VII—Passenger Service Volumes for Class I Carriers

	Train-miles (000)	Loco-miles (000)	Car-miles (000.000)	Tons fuel (000)
1920.....	555,201	583,774	3,580	33,671
1921.....	544,532	568,565	3,462	30,706
1922.....	531,477	556,338	3,405	30,430
1923.....	549,817	577,187	3,577	32,287
1924	553,166	577,769	3,632	30,806
1925.....	552,412	577,728	3,717	29,910
1926.....	550,710	576,771	3,793	30,015
1927.....	539,148	563,866	3,769	28,990
1928.....	521,711	545,424	3,719	27,884
1929.....	513,946	539,657	3,758	27,850

Comparing 1929 with 1920, train-miles decreased 7.4 per cent, locomotive miles decreased 7.5 per cent, car miles increased 4.9 per cent, and tons of fuel consumed decreased 17.2 per cent.

Passenger service data is not recorded the same as for freight service, in that train speed, tons per train and gross ton-miles per train-hour are not shown.

Table VIII shows the unit performances for Class I carriers by years since 1920, and percentage changes of 1929 compared with 1920.

Table VIII—Passenger Service Unit Performances

	Per active loco. day					Pounds fuel per		
	Total miles	Train miles	Light loco. mi.	Car miles	Cars per train	Car mile	Loco. mile	Train mile
1920..	142.4	135.2	7.2	872.0	6.40	17.8	115.4	121.3
1921..	142.3	136.0	6.3	870.0	6.40	17.7	108.0	112.1
1922..	140.3	134.0	6.3	857.6	6.40	17.9	109.4	115.0
1923..	142.3	135.9	6.4	883.4	6.50	18.1	111.9	117.4
1924..	143.0	136.5	6.5	900.9	6.60	17.0	106.6	111.4
1925..	147.7	140.7	7.0	942.7	6.70	16.1	103.5	108.2
1926..	151.9	145.0	6.9	1000.1	6.89	15.8	104.1	109.0
1927..	154.0	147.2	6.8	1019.0	6.99	15.4	102.8	107.6
1928..	158.3	151.4	6.9	1079.5	1.13	15.0	102.2	106.8
1929..	164.6	156.7	7.9	1145.5	7.31	14.8	103.2	108.2
Per cent Inc.	15.6	15.8	9.7	31.9	13.9	...	....	....
Per cent Dec.	...	....	..	...	...	21.2	10.5	10.8

The total miles and train miles per active locomotive day have continued to increase. The light locomotive miles per day are doubtless in excess of terminal mileage and indicate some road helper return mileage. No data is available to determine the amount of road switching, if any. Cars per train continued to increase and the pounds of fuel continued to decrease.

Chart I (not shown) gives the passenger locomotive performance of the 26 selected carriers, comparing 1929 with 1923 as to miles per active locomotive-day, pounds of fuel per locomotive and car-mile, cars per train, etc. This indicates that the pounds of fuel consumed per locomotive-mile are not affected by miles per active locomotive-day. The pounds of fuel per car-mile continue to vary somewhat inversely with the cars per train.

Table IX shows the number of passenger locomotives reported on the OS-B forms for Class I carriers. This shows considerable improvement in the condition of power for service.

Table IX—Passenger Locomotives Reported on OS-B Forms

	Total	Unserviceable	Serviceable	Stored	Active
1920.....	15,555	3,577	11,978	761	11,217
1921.....	15,066	3,479	11,587	644	10,943
1922.....	14,993	3,521	11,472	606	10,866
1923.....	14,555	3,033	11,522	433	11,089
1924.....	14,554	2,689	11,865	794	11,071
1925.....	14,341	2,552	11,789	1,036	10,753
1926.....	13,882	2,365	11,517	1,109	10,408
1927.....	13,511	2,223	11,288	1,256	10,032
1928.....	13,003	2,133	10,870	1,460	9,410
1929.....	12,285	1,984	10,301	1,317	8,984
Per cent. Inc.	.....	....	.....	73.0	....
Per cent. Dec.	21.0	41.7	14.0	...	19.0

Owing to specific train schedules in passenger service, it is felt that more extended runs and more trips per day on short runs could be accomplished.

Yard Locomotive Performance

The volumes in miles and tons of fuel in yard service for Class 1 carriers are shown in Table X.

Table X—Yard Locomotive Performances for Class I Carriers

	100 Miles			1000 Miles			
	Freight	Pass.	Total	Freight	Pass.	Total	Fuel
1920...	332,071	23,875	256,946	55,512	3,979	59,491	24,338
1921...	242,608	21,988	264,596	40,434	3,665	44,099	18,237
1922...	261,987	22,173	284,160	43,665	3,695	47,360	19,495
1923...	319,297	22,919	342,216	53,217	3,819	57,036	24,068
1924...	292,432	23,465	315,897	48,739	3,910	52,649	21,974
1925...	300,632	23,576	324,208	50,106	3,929	54,035	22,176
1926...	315,491	24,166	339,657	52,582	4,028	56,610	23,269
1927...	299,660	24,233	323,893	49,943	4,039	53,982	21,775
1928...	292,713	23,961	316,674	48,785	3,993	52,778	20,834
1929...	(Not yet available.)						

Chart J shows the trends in percentage fluctuation each year compared with 1920. The total freight yard switching miles have been compared with the number of cars per train; the tons per train; total gross ton miles and total train miles, and have been found to vary with the train miles. The reduction in train miles has resulted in reduction in number of freight locomotives used, the tons of fuel consumed, and also the amount of freight yard switching.

In passenger yard service, percentage fluctuations have been compared with cars per train and train miles, and Chart J shows that the passenger yard locomotive miles vary with the cars per train rather than with the train miles, due to reversal order switching at final terminals.

The total number of shifts worked by freight and passenger yard locomotives, and the miles, hours and shifts per active yard locomotive day are given in Table XI.

Table XI—Number of Yard Locomotive Shifts—Miles and Hours per Active Locomotive-Day

	Total shifts (1000)			Per active yard loco. day		
	Freight	Pass.	Total	Miles	Hours	Equiv. shifts
1920.....	6,939	497	7,436	....	.....	....
1921.....	5,054	458	5,512	....	.....	....
1922.....	5,458	462	5,920	....	.....	....
1923.....	6,652	477	7,129	73.0	12.16	1.52
1924.....	6,092	489	6,581	57.3	11.20	1.40
1925.....	6,263	491	6,754	68.1	11.35	1.42
1926.....	6,573	503	7,076	69.7	11.60	1.45
1927.....	6,243	505	6,748	71.1	11.85	1.48
1928.....	6,093	499	6,597	70.0	11.66	1.46
1929..	(Not yet available.)					

This shows that the amount of yard locomotive work per day has not increased with the freight and passenger volumes. It indicates that the number of yard locomotives used can be reduced as the average hours worked per day approach sixteen, or two-crew shifts, except as prevented by local conditions.

Chart L (not shown) indicates that the pounds of fuel per yard locomotive mile are decreasing regardless of the miles per day. This is doubtless due to improved locomotive design, maintenance, improved yard layouts, etc.

Operating Economies

Operating economies result from reduction in train hours and miles while hauling more volume in tonnage. The tons of fuel consumed have reduced because of this. Improved operation has resulted in economies in transportation and equipment maintenance expense, as reflected in Table XIII.

Table XII—Fuel Performance of Yard Locomotives; Freight and Passenger Service Combined

	Pounds fuel per		Tons fuel per	
	loco. mile	loco. hour	loco. day	shift
1920	136.4	818.4	....	....
1921	137.8	826.8	....	....
1922	137.2	823.2	....	....
1923	140.7	844.6	5.13	3.38
1924	139.1	834.6	4.68	3.34
1925	136.8	820.8	4.65	3.23
1926	137.0	822.0	4.65	3.29
1927	134.4	806.4	4.78	3.23
1928	131.4	788.4	4.60	3.15
1929	(Not yet available.)			

Table XIII—Transportation and Equipment Maintenance Economies

	1920	1929
Total operating ratio	94.32	71.69
Per cent of operating expenses		
for maintenance of equipment	27.2	26.6
for transportation expenses	49.8	46.3

There are too many factors involved in comparing costs since 1920, and all the reductions shown are not specifically attributable to improvements in a few items, but the trends have been favorable. The above ratio for maintenance of equipment includes charges for depreciation and retirements.

Fuel Consumption

The total tons of fuel used by locomotives, equating oil electricity, etc., to tons, ranged as in Table XIV for Class I carriers.

Table XIV—Tons of Locomotive Fuel in Thousands—Oil and Electricity Equated

	Freight	Passenger	Yard	Road and Yard	Work	Total
1920	89,925	33,671	24,338	147,934	3,472	151,406
1921	70,303	30,806	18,237	119,246	1,760	121,006
1922	75,694	30,430	19,495	125,614	1,594	127,213
1923	90,263	32,287	24,068	146,618	2,304	148,922
1924	81,025	30,806	21,974	133,805	1,812	135,617
1925	81,316	29,910	22,176	133,402	2,018	135,420
1926	85,895	30,015	23,269	138,379	2,047	140,426
1927	80,427	28,990	21,775	131,192	1,753	132,945
1928	79,313	27,884	20,834	128,031	1,714	129,745
1929	80,817	27,850	———	(Not yet available	———	

In freight service, since 1920 the volume in trailing gross ton miles increased 24.9 per cent and the tons of fuel consumed decreased 10.1 per cent. If the rate of fuel consumption in 1920 were applied to the gross ton miles of 1929, the consumption in 1929 would have been 22,524,000 tons more than actually used. If, in 1929, the fuel consumption per passenger car mile had been 18.8 pounds instead of 14.8, then would have been consumed approximately 7,475,000 tons more than was actually used.

In freight service the unit fuel performances for Class I carriers ranged as in Table XV.

Table XV—Unit Fuel Performances

	Pounds per 1000 g. t. m.		Pounds per			
	inc. loco.	exc. loco.	train hrs.	loco. day	train-mile	loco. mile
1920	173	197	2,928	21,470	283.8	252.3
1921	162	185	2,060	18,478	265.2	236.4
1922	163	186	3,015	17,756	272.3	242.2
1923	161	183	3,065	19,087	281.3	248.8
1924	149	170	3,101	20,104	269.7	240.7
1925	140	159	3,128	19,406	263.8	235.8
1926	137	155	3,204	20,271	268.9	238.3
1927	131	148	3,247	19,956	263.4	233.4
1928	127	143	3,393	20,513	263.6	233.1
1929	125	142	3,442	21,260	264.0	233.2
Dec. Per Ct.	27.1	27.9	....	0.9	7.0	7.5
Inc. Per ct.	...	...	17.5	....	....	....

The pounds of fuel per 1,000 gross ton-miles decreased more when excluding locomotive and tender than when including same, due to heavier power and continued high light locomotive-miles. The pounds per train-hour increased 17.5 per cent in relation to an hourly rate of work of 65 per cent increase. However, the pounds per locomotive-day and train and locomotive-mile continue to decrease.

Further reductions in fuel consumption are expected as the number of more than one crew runs and shifts increase.

The report was signed by the following: Representing the Operating division, T. B. Hamilton, vice-president, Western region, Pennsylvania; J. T. Gillick, chief operating officer, Chicago, Milwaukee, St. Paul & Pacific; R. E. Woodruff, assistant vice-president, Erie. Representing the Mechanical division, W. H. Flynn, general superintendent motive power and rolling stock, New York Central; O. S. Jackson, general superintendent motive power and machinery, Union Pacific; O. A. Garber, chief mechanical officer, Missouri Pacific.

Discussion

J. M. Nicholson, (A. T. & S. F.): Your attention is directed to the increase in trailing gross ton miles in Table 1. You will note that the trend has been upward since 1921 with the exception of the years 1923 and 1927. This increased business has been handled with a reduction in train miles, locomotive miles, tons of fuel, train hours, and fuel per thousand gross ton miles. The train hours show a decided decrease, which has been influenced by the increased speed that has resulted.

In regard to Chart *B*, you will note the gross ton miles per train hour increased continuously since 1922. The miles per active locomotive per day are shown by Curve *F*, and the trend of fuel per thousand gross ton miles by Curve *H*, which has been downward since 1923.

In regard to Chart *D*, you will note that the gross ton miles per active locomotive shows the same upward trend that the gross ton miles per train hour has shown. Active locomotives have decreased since the year 1923.

In regard to Table No. 10, I might state that the information for 1929 was not available at the time the report was printed, but it will be shown in the proceedings. The trend for 1929 shows an improvement in most instances. The trend is shown by the drafts which do include the 1929 information.

Chairman Ayers: I would like to offer the suggestion that the Mechanical Division has a great field in considering this question where it involves not only mechanical matters but transportation matters. I think we have a great opportunity to show what we know about railroading as well as taking care of power by helping the transportation department to find waste and to get more out of the locomotive. The faster the train runs, the more an engine stands around the terminal if you let it.

O. S. Jackson (U. P.): The tabulation of performances is put out quarterly and annually to each of the Class I railroads, with the purpose and thought to interest all managerial officers, to promote and secure a better utilization of their locomotive investment with the consequent economies to be attained. As these statistics speak for themselves, showing a substantial progress made during the past ten years, I am going to dwell on methods, which from experience have enabled us to attain some very gratifying results.

The two major factors of locomotive performance are: first, operation; second, maintenance. By operation I have reference particularly to the opportunity of extended locomotive runs which on the Union Pacific have been taken advantage of to the fullest extent.

This has enabled the establishing of well-defined economies by decreasing the active locomotives required to cover a prescribed territory, resulting in increased locomotive miles per locomotive day through reducing the number of lay-over terminals and providing a minimum number of assigned locomotives to handle a certain volume of traffic.

Our through locomotive runs in passenger service are now from 509 miles to 877 miles, whereas formerly the engines operated on districts from 102 miles to 175 miles long. Likewise in through freight service our locomotive runs are now from 162 miles to 325 miles as compared with the old practice of 75 miles to 147 miles. The extended locomotive runs have passed the experimental stage, and are an accepted and successfully operated practice on the railroads generally.

The problem of maintenance was also carefully studied, in order that locomotives would be maintained in a proper condition to carry through on these runs, and to avoid the necessity or probability of engines being held an excessive number of engine hours at enginehouses for repairs.

Our investigation in this field developed that no definite or co-ordinating practice of running repair maintenance was in effect. This resulted in engines being held intermittently, from time to time throughout a monthly period as convenience would afford, for handling the particular classes of work. To overcome this, we successfully developed and placed in practice a plan known as the Periodical Monthly Inspection, at which time each locomotive is given a thorough inspection, the necessary work done to omply with the Federal Regulations, and at the same time place that locomotive in condition to operate throughout the next 30-day period without being held out of its run. This has co-ordinated the work of all departments, machine, boiler, electrical, etc., and provided a substantial increase in the number of available engine-hours for each locomotive day, and has assisted us in maintaining a minimum assignment of active locomotives.

A further study of our locomotive conditions developed that the practice of shopping locomotives on a basis of months' service was not conducive to meeting modern business practices, and that such a procedure or plan permitted engines to be shopped in many instances on short terms of actual service. To overcome this condition, we established the practice of providing a definite mileage requirement for each class of engine, giving consideration to territorial operating requirements such as water and other conditions affecting the service life of the engine. As a result of this, our Mallet type engines, which were formerly placed in shop after 12 months' service with an average of 40,000 locomotive miles, are now running 24 months between general shopping with an average mileage of 93,000 miles. Our Pacific type engines, which formerly operated from 14 to 16 months with an average of 125,000 locomotive miles, are now giving us 18 to 24 months' service with 180,000 to 200,000 miles. Our Mikado type with 14 to 16 months' service averaging 60,000 miles, are now making 18 to 20 months with an average of 89,000 miles. The months' service and mileage has correspondingly increased on our other classes of heavy power, the 2-10-2 type and Mountain type. With our Union Pacific three-cylinder type engines we are obtaining from 125,000 to 140,000 miles between general overhaulings.

This plan provides for taking advantage of the full mileage opportunity of flues and machinery in such territory. Where water conditions are extremely favorable we have been able to obtain the full benefit of flue service up to the Federal limit by giving such locomotives intermediate light machinery shoppings. In territory where operating conditions are more favorable to the machinery, we have been able to obtain the full mileage opportunity of the machinery by intermediate light shopping for flues.

We also studied the problem of our shop production, and the days held in shops of locomotives undergoing classified repairs. This resulted in working out and adopting a production system and scheduling of engines through shops. From this practice we have developed surprising results. For illustration: Class 1 and 2 repairs, which required 42 shop days, are now being performed in 19 shop days. Class 3 repairs have been reduced from 28 shop days to 17 days; Class 4 repairs from 21 days to 16 days; Class 5 from 13 days to 10 days. The general average days in shop for all classified repairs has been reduced from 19 to 12, or approximately 37 per cent.

All of these practices have a direct relation to increasing the utilization of locomotives as well as the advantages of operating and maintenance economies. There are, no doubt, other factors which will enable us on further study to continue progress along these lines. We solicit and are endeavoring to apply any constructive ideas which may come to us, and are also correcting conditions which are pointed out through the development and use of statistics such as given in the committee reports which indicate in operating performance, avenues for study and investigation for potential improvements.

Our fuel conservation program has been followed out on similar lines, and much has been accomplished beyond the application of fuel-saving appliances. I have particular reference to operating changes, mechanical maintenance, and the educating of the operating and mechanical employees along constructive lines in eliminating fuel waste, as well as securing fuller utilization of fuel energy.

To obtain the greatest utilization of locomotives you must have the full support of your general manager and your superintendent and train dispatcher. Often the dispatcher, of course, would like to have a lot of engines waiting to be dispatched, which we think in many cases is wasteful and expensive in the maintenance of our locomotive equipment.

We feel that keeping an engine in service and keeping it active while in service, giving the greatest possible miles per locomotive day or month is economical. The long locomotive runs we feel have enabled us to make a splendid showing, and that is shown by the committee in its statistical report.

C. J. Bodemer (L. & N.): Mr. Jackson indicated quite a lot of mileage between general overhaulings of his Pacrific type and Mountain type engines. I believe 180,000 miles, and 90,000 miles between general repairs. I am interested in knowing whether that refers to Class 1, 2 and 3 repairs only, or whether Class 4 and 5 repairs enter into that.

Mr. Jackson: That applies to 1, 2 and 3 Class repairs. We give them intermediate Class 5 repairs, and in some cases Class 4 repairs.

J. E. Bjorkholm (C., M., St. P. & R): Some two years ago when we were discussing the question of extended locomotive runs, a good deal was said as to whether it was economically possible to run engines over five, six and seven hundred miles without fire cleaning. I presume that all of us felt at that time that the conventional run was just about as far as we could go, particularly in those regions where we were burning coal containing only some 10,000 or 11,000 b. t. u.'s, and only from 12 to 18 per cent ash. Since then practically all roads who have entered into the program have demonstrated that we were all wrong.

Today the C. M., S. P. & P. is running locomotives 915 miles in passenger service on through runs without detaching the engines from the train, and the longest stop at any one point is seven minutes. I think that illustrates conclusively what can be done.

After inaugurating this practice of extended runs we ran between Chicago and the Twin Cities continually changing locomotives at Milwaukee, which enabled us to withdraw not less than 25 units from the service, and make a payroll reduction at the Milwaukee roundhouse of $18,000 per month. I think you will agree with me that money saved is money which is not spent, and when you take money off the payroll and do not put it anywhere else you are saving real money.

During the past three years we have withdrawn through the inauguration of long engine runs some 50 superheated Pacific type engines from passenger service, engines with a tractive effort of something like 44,000 lbs., and these engines have been placed in time freight service on other divisions, and, of course, by doing so we have materially reduced our fuel consumption.

The mileage which Mr. Bodemer spoke about I think is about typical. We make something like 200,000 miles between shoppings, if we forget to talk about classified repairs. But if we include classified repairs, or even roundhouse repairs in dropping all the wheels, and so forth, I presume it would be closer to the truth if we would say that we were making around 75,000 to 90,000 miles between shoppings.

During the past few years we have been able to reduce the maintenance cost something like seven cents per mile, and I dare say that the largest credit for that reduction should go to the reduction of units in service through the medium of long locomotive runs.

C. E. Brooks (C. P.): We have during the past five years been operating Mountain type locomotives across the prairies between Winnipeg and Edmonton, a distance of 800 miles and we are also operating in eastern Canada about relatively the same distances and as high as 500 miles in freight service.

The general practice of extending locomotive runs has gone into effect practically all over the system wherever it has been possible to work out any economy and yet I regret to say that we have not seen the returns in either operating costs or the increased utilization of the locomotives that we expected. Perhaps that is entirely our fault and yet in reviewing the situation and comparing ourselves with some of you gentlemen, I cannot but realize that we are at least normal in our operation.

I have one particular railway in mind which has probably the finest fuel record of any railway on this continent. It has a cost record of somewhere around fifteen cents per locomotive mile for repairs and they have no extended runs.

When you know and realize such conditions as that you have to make up your minds if you are not biased that there is something besides the glib remedy of extending runs. There is something far greater than that in the standardization of the locomotives which are in main line or important service all over the railroad and the reduction insofar as possible of the very many so called fuel saving devices which we are in many cases, I think, adding to our equipment without a great deal in the way of returns.

We have endeavored to take advantage of every reasonable fuel saving device which we know of and in some cases as time went by we began to realize that some of these devices were a most important factor in holding large locomotive power out of service.

I don't wish to have these remarks interpreted as being remarks which would tend to have us turn back to conditions of ten or fifteen or twenty years ago but insofar as my own experience is concerned I realize and know that increasing your efficiency over the railroad depends on something a great deal more than merely driving locomotives 800 miles without disconnecting them from a train.

A. A. Raymond (N. Y. C): You might go over to our line some day and be surprised to see a Hudson type engine on a two-car train. That is the first thing that hits you, there is a great big engine on a two-car train. I want to explain it so you won't think we are out of line on our power. We try to extend the locomotive runs and one day up at Buffalo they said, "Why do we need these engines taking cars over to Niagara Falls? We have 100 trains coming in here every day and why bring another engine into the depot and have her run these trains. Why not use the engines already here?"

There were through runs in that territory. There is a train that runs from Albany to Syracuse on a through run that takes a local over to Niagara Falls, to Buffao, and it runs a round trip to Niagara Falls and comes back. Now that makes up about eight different trains put together. We wondered what we were getting out of these through runs, whether we were saving engines. We tabulated our mileage and as near as we could tell with these through runs we are doing the business with about 35 per cent less engines. That is an astonishing fact, but that is just as close as we can get to it and if you discount that 10 or 15 per cent you still have a big factor. We have run passenger engines from Harmon, N. Y., to Chicago for a number of years, and taking the overall efficiency of those engines reaching their destination, it runs about 90 per cent. We are cleaning the fires on those runs and we think that shortly we will be able to eliminate that.

There is one thing about freight runs that is quite a challenge to our ingenuity, our capability of organization. You get a freight train in at a terminal and perhaps that train doesn't move out for three or four hours. That engine is there. Are you going to hold it or put it in another train. Then there are a number of freight trains which come in and the engines go into terminals. How many hours does it take to get that engine out again?

Let me put it this way: How many hours after an engine arrives at a terminal before you have had it completely inspected and know what you have to do with it? Let's compare that with some of the bus organizations. Suppose you were general manager of some concern and with 300 buses and somebody wanted to buy some more. You would start looking around to find out if there were any extras. You would go into some garage and there are maybe some 15 buses there. You say to the man in charge of the garage, "How about that bus? Can't you use that?" He says, "I guess she is all right, but I don't know." You say, "How long has she been here?" He says, "She has been here some three or four hours." You would tell him to inspect these buses the minute they stop so you will know what you can do and not buy more until you use the ones you have stored. Isn't that what you have to do with engines? We have to get an engine and inside of an hour after it reaches the terminal we should know whether it needs heavy or light repairs and when it will be ready for service again. Can't you look at a roundhouse as a kind of endless conveyor? An engine gets on the conveyor and it gets out when the engine gets to the other door.

I believe we have a big problem. These big engine runs opened up a lot of other problems we have to solve, and until we get this engine terminal problem solved we can't get efficiency out of our through runs.

Mr. Bjorkholm: I should have said in talking about our runs where we get some of the money. We are so located at a good many places that the passenger depots at our terminals are from five to six miles away from the roundhouse and at Milwaukee we were confronted with a situation where we had to take some 30 passenger engines a day about four miles with a hostler and helper, and, of course, that was dispensed with when the new runs were inaugurated.

With a close study of the fuel consumption from the

time the engine arrived at the depot until it was again dispatched on a run with the standby loss in the pit, the firing of coal, etc., amounted to something like a ton and a half to the locomotive. That would be a ton and a half multiplied by the number of engines, and at the end of the year that is a nice pile of coal.

Some long runs which have been inaugurated are not long locomotive runs at all. To start a locomotive going west and continue going west regardless of the time element and regardless of waste is not in my estimation a long locomotive run. A long engine run is where an engine is in continued service and kept going. Perhaps at times we are a little too optimistic. However, the world is built on optimism, and I will say this, on our particular road the long run has paid for itself.

Peculiar conditions of each property must be studied before a run can be placed in effect economically. We have placed runs in effect on our road and withdrew them because we found they were not an economical proposition, but as a general rule I want to say to you they have been very profitable.

D. B. Hall (C. & N. W.): Answering Mr. Bodemer's questions regarding classified repairs, we have inaugurated a system not exactly in line with Mr. Jackson's, but in line of increasing the miles of classified repairs. We require the master mechanics semi-monthly to give us an anticipated repair report showing the locomotives on their divisions which will require certain repairs within the next 30, 60 or 90 days, and, in addition to this, we require them to show the cost per mile run to date. We watch more closely the cost per mile run than we do the increased mileage between classified repairs.

There is no question that if we want to, any of us can increase the mileage between classified repairs if we take them in often enough for four or five repairs. That, in my mind, isn't as essential as keeping your cost down. We all get the cost figures and we know what others are doing. We all know we have to absorb in our costs the increases for labor and material and, if you do that which I have done, I find most roads have made efficient reductions in repair costs, and I assume that is brought about by long runs and a more systematic method of checking up costs. We all have been more prone to check costs these last few years than we did some time back. There was a time when if a locomotive needed repairs you put her in and didn't figure costs. Today it is a dollar and cents proposition.

We are operating mountain-type locomotives in passenger service 350 miles. The reason we are not operating further is because of lack of facilities—we are not able to take fuel. If we do it on the present schedule we can't do it on time. When we have better facilities we hope to operate 500 miles, that is, between Chicago and Omaha. On freight service we are operating through at the present time, that is, on our time-freight and fast-freight schedules. The dead freight trains are nearly a thing of the past. We have a few on the whole road.

The most important thing to watch is the cost per mile run. If you can get your cost reduced by not making intermediate repairs, that is the thing to do, and there are some locomotives on some roads where that works out nicely. There are others where one intermediate repairing is all you can get.

Mr. Jackson: In connection with the subject of long locomotive runs, I might mention to you one benefit that possibly some of you have not thought of, and that is minimizing the work at small terminals. We find that with the long runs we have less engine failures than we had when we had more terminals and the engines received temporary attention after making 150 miles or a shorter run. Generally it has been my experience that the attention given engines at those terminals is only temporary or patchwork, while on long runs you must start the locomotive out in proper condition, and that reduces engine failures.

Also, I think in establishing long locomotive runs we can reduce the expense of building and improving a lot of the small terminals. I would much prefer to use that money at our larger terminals, having a first class roundhouse, first class tools and facilities to do a first class job, instead of possibly doing a patch job which has been more or less the practice at small terminals on short runs.

Mr. Nicholson: Mr. Bodemer raised a question that the committee gave considerable study to in its activities some two or three years ago, and that has to do with the mileage between Class 5 repairs. There are railroads on which the subcommittee made some investigation that break mileage between any class of repairs. There are other railroads that break mileage between Class 3 or heavier, and there are certain conditioning repairs intervening in which mileage is not lost. Without knowing the practice of the various roads it is difficult to compare mileage on locomotives between so-called repairs when we do not know what they are, or what the intervening repairs are.

There is also a difference in opinion as to the proportion of the repair costs that should be spent in roundhouses, and its relation to the total cost of repairs. The final analysis will necessitate a study of the cost per mile on total repairs, because of the fact that some roads vary as much as 25 per cent in the relation of running to total.

The layover period is a matter that has to be watched carefully. If in starting an extended locomotive run the assignment is not reduced, the mileage made by the locomotives on extended runs will be about the same as made on short runs. It is necessary to reduce the assignment in order to keep the mileage up to what it should be.

The question comes up as to what the assignment can be reduced to. There are a number of extended runs being operated where the idle time when the locomotive is not in transportation service is approximately 50 per cent of the total. There are schedules that will not permit this great utilization, but such runs are being operated with substantial improvement in mileage.

In building up to the extended locomotive run program it is important to centralize repairs, and do repairs of a quality that will improve the condition of the locomotive for terminal service rather than patchwork repairs that have to be done again, or done properly at the final terminal.

J. Purcell (A. T. & S. F.): In increasing the mileage on locomotives the governing factor, as we found it, is water condition; grade condition is another; size of trains is another; speed condition is also brought into the matter.

There is absolutely no use of running a locomotive of 54,000 lb. tractive power for 300 miles on a train that does not require an engine of, say, over 30,000 lb. tractive power to handle that train on that particular track grade. You are wasting power, because in moving a large locomotive, or any locomotive, the fuel consumed handling that locomotive alone is almost half the fuel used in handling a train in addition to the locomotive.

Several years ago we started on long runs. We formerly had 16 locomotives on our transcontinental trains

from Chicago to Los Angeles. Now we have five. If we had water conditions and fuel conditions that were different, the situation might be changed. We use coal from Chicago to Kansas City. From Kansas City to La Junta, Colo., we have oil. We get the oil in that district. The grade conditions from La Junta to Los Angeles are about the same. We have something like 575 miles of heavy grades. Another point is that we have automatic train control over certain districts, and we can't run the average locomotive over them.

We have studied it out on our line, and I presume all the rest of you have, too, and we have come to the conclusion that in the long run there are conditions where you will save lots of money and save lots of power, and there are other conditions under which you will not. It depends, as I said, on your grade conditions, water conditions, and your fuel conditions. It would not pay us to haul oil clear to Chicago. And it would not pay us to haul coal in certain districts, because we have oil in those districts. We have got to be governed largely by the source of fuel and grade conditions.

In regard to freight locomotives, if you will start your locomotives out of a terminal in a safe and suitable condition to handle your train to the next terminal at time-card speed, you will have done a good job.

(*A motion to accept the report was carried.*)

Report of Committee on Resolutions

WHEREAS, the Railway Supply Manufacturers' Association has this year exceeded all exhibits formerly made, which have been so successfully and interestingly explained to all officers by the individual firms' representatives, and have so generously arranged for the entertainment of members and families of the Mechanical Division,

WHEREAS, the Mayor and people of Atlantic City, in providing this most wonderful Auditorium and other courtesies extended, have continued to make this a city so much to be respected and inviting to our convention,

WHEREAS, the Atlantic City Hotel Men's Association has provided so comfortably for our sojourn while in this City.

WHEREAS, we do appreciate to the fullest extent the attendance and most helpful addresses given to the convention by R. H. Aishton, Hon. Frank McManamy, W. P. Borland, M. H. Gormley, S. M. Vauclain, A. G. Pack, the individual paper by R. L. Kleine outlining a yard inspection pit for freight car equipment and the moving picture showing the power-brake tests which was furnished with the aid of Mr. Purcell and his staff, also the moving pictures on "Operation of the Steam Locomotive".

WHEREAS, the *Railway Age,* as is its usual practice, has in such a prompt and fitting manner, printed all committee reports and discussions and edited the daily arrivals,

WHEREAS, the committees have so fully compiled their reports and presented them in such a forceful and interesting manner.

WHEREAS, the Pennsylvania Railroad has so successfully arranged for special convention trains and, with the Reading Company and Central of New Jersey and other railroads, has so liberally provided transportation to the members and their families to enable them to reach Atlantic City.

WHEREAS, the continued interest of the executives of the American Railway Association and of the railroads in the Mechanical Division lends inspiration to our future work,

WHEREAS, the meetings of the present convention have been so ably planned and guided by the officers, the secretary and his staff, the subjects prepared of such unusual interest bringing forth more than the usual discussion,

Be it resolved, that the thanks and appreciation of the Mechanical Division be extended to all of the aforesaid mentioned who have in any way a part in making it possible for this to be one of the largest and most interesting conventions ever held.

(*The resolutions were adopted.*)

Closing Ceremonies

Mr. Tatum: Mr. Smart has displayed that love, affection, and ability which others of his countrymen in this organization have done. For this we feel grateful. He has presided over this organization for nearly three years, serving the unexpired term of Mr. Sillcox, and his own full elected term, during which time he has been fair and impartial in the performance of his duties.

In consideration of his work, kindness, and the ability he has displayed, this organization wishes him to present him with the past president's badge. I present this badge to you, Mr. Smart, and I know that you will wear it, as have others who have preceeded you, with honor and credit to this Association. (Applause)

Chairman Smart: Mr. Tatum, I thank you. You are certainly a past master in making these presentations.

Any success which I have had in conducting these meetings have been due to your assistance—the assistance of the officers and of all others—and to the great help of our secretary. If there is anybody who can make the term of chairman a success, it is the secretary of an organization. Mr. Hawthorne and his staff have assisted me greatly in conducting these meetings.

Another gentleman has been of the greatest assistance to me with his counsel and advice. While I am not much younger than he is, he certainly has me beat in railway service and in his knowledge of conducting meetings. I have had great pleasure, Mr. Purcell, in coming to you for advice as to the conduct of these meetings.

I certainly will wear this badge with pleasure, always looking back on the pleasant time I have had as chairman of these meetings.

After passing a resolution of appreciation for the character of service rendered by Mr. Smart as chairman, an engrossed and framed copy of which will be presented to him, the convention adjourned.